

**The Moods of Modernity:
Germany in the Age of Telegraphy, c. 1830 – c. 1880**



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Short Abstract

This thesis investigates the origins and impact of electrical telegraphy in Germany between 1830 and 1880, situating them within the context of long-term transformations in the theory and practice of communication. It uses the development of telegraphy as an analytical lens through which to explore the connections between actors at the heart of the socio-economic transformations taking place in Germany during the period. Both as an innovation and as a tool of communication, this thesis argues, the telegraph epitomised the simultaneously growing interdependence and differentiation between people and places which was a defining characteristic of modernity.

By exploring the motivations and interactions of scientists, entrepreneurs, state officials, and ordinary users who engaged with the technology, this thesis highlights the diverse expectations which were placed upon telegraphy, and the many different directions in which its development was pulled. In doing so, it reveals the ties between the ‘modernising’ processes with which the technology has been associated. It challenges linear narratives of technological innovation which focus exclusively upon individual or state actors, emphasising the cooperation and collaboration across society which was necessary to produce the telegraph. It similarly questions triumphalist interpretations of the ‘communications revolution’ so often attributed to the nineteenth century, emphasising instead the tensions and divisions which it also generated. Revisiting the themes of industrialisation, capitalism, community and bourgeois class-formation in nineteenth-century Germany in this light, this thesis emphasises their intrinsic interdependence, and the inevitable mixture of hopes and anxieties, expectations and frustrations, which it produced.

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Long Abstract

This thesis investigates the origins and impact of electrical telegraphy in Germany between 1830 and 1880. It places the technology within the context of long-term transformations in the theory and practice of communication in Western Europe since the sixteenth century, which reconfigured the relations between individuals, society and the state. It uses the development of telegraphy as an analytical lens through which to explore the particular ways in which these relations evolved in Germany during the nineteenth century. Both as an innovation and a tool of communication, it argues, the telegraph epitomised the simultaneously growing interdependence and differentiation between people and places which was a defining characteristic of modernity.

This study considers the role of numerous actors in the development, implementation and utilisation of telegraphy in nineteenth-century Germany. It draws inspiration from approaches taken in the history of science and technology, which have illustrated the potential for objects and ideas to ‘enrol’ participants in their elaboration, tying them into the surrounding socio-economic, cultural and political context. Using a wide array of published and archival sources, it explores the motivations and interactions of scientists, entrepreneurs, state officials, as well as ordinary users of the technology, spotlighting their hopes and frustrations - the ‘moods’ which characterised the German experience of modernity.

Challenging linear narratives of technological invention, this thesis argues that telegraphy was the product of both conscious and unwitting collaboration between individuals, groups and institutions across society, who shared a diffuse vision of long-distance communication. There has been much debate in the historiography of Germany

as to the respective roles of ‘science’, ‘technology’, entrepreneurs and ‘the state’ in the early stages of industrialisation. Much of this work has been oriented by the question of Germany’s purported ‘divergence’ from Western European trajectories of development, and the emergence of particular bureaucratic structures, bourgeois ideals, and methods of research and production. In contrast, building upon more recent research, which has demonstrated the considerable diversity and overlap within and between these categories, this thesis argues that technological development depended upon exchanges of knowledge across a wide ‘landscape of innovation’. From the 1830s, representatives of both the state and the private sector dispersed across Germany actively engaged with one another in order to gather the intellectual and financial resources required to bring the telegraph to life.

The implementation of telegraph networks, meanwhile, is commonly understood as a key contributor to the ‘communications revolution’ that is associated with the nineteenth century. In conjunction with railways in particular, telegraphy is seen as a technology which transformed Europeans’ experiences of time and space, accelerating their pace of life, shrinking distances, creating new national communities, and strengthening relations between imperial metropolises and colonies. More recently, it has been investigated as a fundamental force in the process of globalisation, and the worldwide expansion of market capitalism. At the same time, however, historians have demonstrated that the period was marked by increasing regional and social differentiation, as well as global inequalities, phenomena associated with the uneven distribution of power between ‘centres’ and ‘peripheries’.

By exploring the construction and use of telegraph networks at a local, regional and national level in Germany from the 1850s onwards, this thesis suggests that the ambiguities identified by historians were intimately related to the connections which the technology forged. As it cut across geographical and social boundaries, the telegraph created opportunities for the coordination of activities between individuals throughout the country, but it also fostered the creation of new communities and new forms of economic activity. By tracing its development, this thesis therefore sheds new light upon the connections between industrialisation, capitalism, class formation and the re-shaping of local communities which characterised Germany in the second half of the nineteenth century.

A chronological structure has been adopted throughout the thesis, in order to trace the growing interdependence over time which is identified here as a central feature of the modern era. Particular emphasis is placed upon developments in the Kingdom of Bavaria, in order to provide a counterpoint to the traditional emphasis upon Prussia in the historiography of Germany, and indeed of telegraphy. Nevertheless, the sources for this research have been drawn from a number of archives across Germany, as well as published material, so as to provide a representative picture of changes throughout the country. Journals, textbooks and essays, as well as a number of newspapers have been consulted, which provide an insight into the concepts of communication and telegraphy which were circulating at the time. Material from the Bavarian *Hauptstaatsarchiv*, meanwhile, as well as regional archives in Bremen, Nuremberg and Duisburg shed light upon the different administrative processes behind the technology's implementation. The correspondence of key figures, such as Carl Gauß, Carl Steinheil, and Werner Siemens has also been examined, in order to reveal the concerns of scientists and entrepreneurs during the period.

Part I explores the process through which the telegraph was developed into a useable technology, between 1830 and 1847. Chapter One focuses upon the 1830s and argues that a widespread awareness of the possibilities of telegraphic communication had created a broad 'horizon of expectation' which drew together intellectuals, scientists, state officials and even railway companies in the hope of materialising their ambition.

In this section, the works of Friedrich List and Robert von Mohl provide examples of attitudes to communication in German political thought during the period, and their struggle to accommodate newly acknowledged economic forces with the tenets of Cameralism which they had inherited. The correspondence of the scientists Carl Gauß and Carl Steinheil, meanwhile, reveal how their research projects merged with their prior interest in telegraphy, as well as the networks of knowledge exchange between academics across Germany through which it was discussed. Railway companies, on the other hand, saw in the technology a potential means of improving the efficiency and profitability of their services. By the late 1830s, animated by the desire to bring their visions to fruition, these actors turned to one another and to the state, as a means of gathering the financial, logistical, and technical resources which they required.

Chapter Two focuses upon the collaboration which ensued during the 1840s, as connections were forged between the state and the private sector in Bavaria, Prussia and Austria. Now, this chapter argues, earlier expectations were confronted with the sobering reality of technological development. On one hand, the efforts of the state, scientists, and railway companies were supported by the increasingly free circulation of technical knowledge between institutions, experts and private citizens scattered across the German 'landscape of innovation'. The example of Werner Siemens, a Prussian lieutenant posted in Berlin, is used to illustrate the social connections which often supported these exchanges of information. On the other hand, the period also witnessed an accentuation of the tensions between and within the private sector and the state, which sought to establish its own interest in obtaining the technology. This combination of necessary collaboration and disagreement caused frustrations which, by 1847, threatened to stall the process of development.

Chapter Three focuses on the period of the 1848/9 revolutions, and in particular the geopolitical re-configuration of Germany which was initiated as a result. These events, it argues, released many of the tensions which had emerged in the preceding decade, by encouraging German governments to take charge of the production process and to establish telegraph networks for administrative purposes. It investigates the process of negotiation which took place between governments seeking to establish their first extensive telegraph lines, suggesting that these created a new form of interdependence between states. This chapter also provides an opportunity to revisit the role of the Frankfurt National Assembly which was convened in 1848, and the extent to which it came to influence the arrangements made between German governments. The constitution drafted by the Assembly highlights efforts to impose an understanding of communications networks based upon liberal economic principles.

Part II continues to trace the technology's development once it had been implemented as a means of communication. Chapter Four follows the implementation of the technology during an era of 'reaction', investigating the influence of liberal deputies in parliament, as well as local representatives across Bavaria, in imposing economic priorities in the planning and construction of telegraph networks. This chapter also provides an opportunity to consider who the earliest adopters of the technology were, and the utility of the networks to an emerging *Wirtschaftsbürgertum*. The privilege of obtaining access to the telegraph, I argue, created an elite which was able to

adopt more rapid and better coordinated rhythms of business and administration, ‘de-synchronising’ different sections of state and society. The work of Karl Knies is explored as an example of the impact of these changes upon the underlying intellectual current and prevailing understandings of communication.

Chapter Five details the divisions which emerged during the 1860s among users themselves, as states pursued efforts to provide a ubiquitous telegraph service. During this period, the network was reconfigured to cater to the needs of towns dispersed across territories and engaged in different economic sectors. This chapter focuses upon the hierarchies which nonetheless emerged among users, as the state attempted to manage a growing network ‘organically’. The homogenous time-zone which was supposed to exist across telegraphic space was counterbalanced by the distinctions established between larger and smaller channels of communication, creating the impression that some localities were ‘ahead’ of others. A discussion of the positioning of local telegraph offices explores the impact which the new service exerted upon urban communities, and the distinctions which had emerged within the commercial bourgeoisie.

Finally, Chapter Six illustrates the position occupied by telegraphy within the structure of the German Kaiserreich of 1871. It argues that the coordination required to manage the network placed the Reich within a system of interlocking parts. This provides an opportunity to investigate the ‘federal’ nature of the Reich, and its relations with the states of Bavaria and Württemberg which maintained the right to manage their own telegraph networks, as well as the private sector companies which were crucial to their operation. In this section, the debates that took place in the Reichstag concerning the administration’s policies highlight the technology’s intrinsic relationship to developments in other sectors of the economy, and the political divisions and alliances which it produced as a result.

The debates also reveal a further change in concepts of communication, as the exclusive nature of the technology was called into question. The capacity for the telegraph to ‘annihilate space’, it is argued, was increasingly doubted, as it simultaneously fostered a greater sensitivity to distances. Through the deputies’ discussions of the telegraph, the growing concern for social, in addition to economic issues is highlighted, as alliances were formed around the relative value of distance to different groups.

The final section of this chapter investigates the consequences of the network's broadening user-base within local communities. As multiple telegraph offices and new services were provided to cater to the needs of larger sections of local populations, the growing socio-economic fragmentation of communities was revealed, but also symbolically re-structured in new ways. The thesis concludes by suggesting that the narrative of growing social interdependence, argued here to have characterised the telegraph's development, proceeded into the late-nineteenth and twentieth centuries as new media emerged.

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Abbreviations

- AWG: Gauß Briefwechsel = Akademie der Wissenschaften zu Göttingen: Carl Friedrich Gauß Briefwechsel
- BHStA = Bayerisches Hauptstaatsarchiv
- DMM = Deutsches Museum Archiv, München
- DÖTV = Deutsch-Österreichischer Telegraphen-Verein
- DPJ = Dingers Polytechnisches Journal*
- EBZ = Eisenbahn-Zeitung*
- GDVA = General-Direktion der Verkehrsanstalten
- GStA = Geheimes Staatsarchiv Preussischer Kulturbesitz
- HM = Handelsministerium (Ministerium des Handels und der öffentlichen Arbeiten)
- ISGFM = Institut für Stadtgeschichte, Frankfurt am Main
- KGB = Kunst- und Gewerbe-Blatt des polytechnischen Vereins für das Königreich Bayern*
- MA = Ministerium des königlichen Hauses und des Äusseren
- MInn = Ministerium des Innern
- SCA = Siemens Corporate Archives
- StAB = Staatsarchiv Bremen
- StAN = Staatsarchiv Nürnberg
- VDR = Verhandlungen des Deutschen Reichstags*
- VKA = Verhandlungen der Kammer der Abgeordneten des Bayerischen Landtages*
- VKR = Verhandlungen der Kammer der Reichsräte des Bayerischen Landtages*
- ZBLG = Zeitschrift für bayerische Landesgeschichte*

Conventions

Throughout this thesis, I have chosen to remain as close as possible to the terms used in the source material. The names of regions and institutions, functions, and personal titles have been maintained in the original German. Those which are lesser-known or peculiar to their regional context have been italicised. For ease of reading, however, established English equivalents have been used for towns, ministries and the Frankfurt *Nationalversammlung* (National Assembly), as these are frequently evoked.

Unless otherwise stated, all translations are my own.

Introduction

In April 1849, as a number of German state governments began to roll out their first telegraph networks, one of the technology's pioneers, Carl Steinheil, complained that, '[d]espite the extent to which the number of written works on galvanic telegraphs has already grown, in none of these does one find what one is looking for – namely, a clear and comprehensible presentation of the different principles upon which they are based'.¹ Steinheil was not alone in bemoaning the overwhelming complexity of the field which his own work had arguably helped call into existence. A year later, in a textbook on telegraphy aimed at 'friends of physics, telegraph personnel, engineers, technicians, and mechanics', the school teacher Heinrich Schellen hoped that his work would 'bring a certain order to the great mass of electro-telegraphic experiments, and to the motley tangle of inventions, constructions, priority contests and the like', which they had engendered.²

The matter was put rather more elegantly in 1857 by Karl Knies, a founding father of the 'Historical School' of economics. 'Whoever seeks to evoke the impact and benefits of the telegraph' he wrote, 'soon witnesses a vision, like that of a tree which, from a trunk which is easily spanned, shoots out many branches and limbs, which themselves carry innumerable leaves and constantly swell with new sprouts and buds from the invisible passages and chambers of its lifeblood'.³ For Knies, telegraphy became too broad a topic to 'span' once it had come into use, but the examples of

¹ C. A. Steinheil, 'Beschreibung und Vergleichung der galvanischen Telegraphen Deutschlands, nach Besichtigung im April 1849', *DPJ*, 115 (1850), p. 181.

² H. Schellen, *Der elektromagnetische Telegraph in den einzelnen Stadien seiner Entwicklung* (Braunschweig, 1850), p. v.

³ K. Knies, *Der Telegraph als Verkehrsmittel, mit Erörterungen über den Nachrichtenverkehr überhaupt* (Tübingen, 1857), p. 190.

Steinheil and Schellen suggest that the problem went further back. From the myriad scientific and technical roots of Knies' metaphorical tree, to the multifarious ramifications of its application, broaching the topic of 'telegraphy' as a concept, invention and means of communication posed much the same challenge for contemporaries as it does for the historian today.

As a result, the history of electrical telegraphy continues to reflect these long-term efforts to streamline the complexity of its origins and impact. Each from his own perspective, Steinheil the scientist, Schellen the schoolteacher, and Knies the economist had begun to categorise the technology in particular ways. The ordering which Steinheil called for was being carried out as he wrote; the 'principles' of electricity upon which telegraphy rested, from Volta to Ohm, were being assigned to the new discipline of physics. Like many similar works, meanwhile, Schellen's textbook provided a linear account of the various inventors and inventions which had contributed to telegraphy. In his study, *Der Telegraph als Verkehrsmittel*, Karl Knies singled out telegraphy's role in the dissemination of news in particular – his '*Erörterungen über den Nachrichtenverkehr überhaupt*' created a space for the technology in a new field of press, or 'media' studies. Already, the technology was being unpacked to enable the author, and historians ever since, to focus upon a particular quality, actor, political entity, or social category with which it was associated.

This thesis instead recovers Heinrich Schellen's 'motley tangle' of inventors, thinkers, administrators and users who were drawn to electrical telegraphy, in order to highlight how it was shaped by, and in turn transformed their world. It spotlights the open-ended nature of the technology's development and application in Germany between 1830 and 1880, revealing the diverse array of actors involved, their

motivations, and the many directions in which the technology was pulled. In doing so, it illuminates the connections between the different narratives which have since coalesced around the telegraph.

The existing literature on the early years of electrical telegraphy in individual European countries remains limited, particularly regarding the context of its origins and implementation. For Britain, Jeffrey Kieve's 1973 work on the 'social and economic history' of telegraphy is still a standard, though rather outdated reference.⁴ The same might be said of Catherine Bertho's nonetheless very useful introduction to the topic in France.⁵ Inheriting the kind of framework proposed by Schellen, these works tend to present the emergence of telegraphy as a simple succession of innovations. They then focus primarily upon the administrative decisions, personnel and institutions which were set up to manage telegraph networks in each state.

For Germany, no sustained analysis of the political, social and cultural implications of telegraphy exists. A relatively comprehensive, though once again linear overview of basic developments is provided by Horst A. Wessel, whose analysis, however, is in fact focused upon the role of the Rhineland industry in the production of the materials of communications technologies.⁶ To a lesser extent, Josef Reindl also discusses the early stages of German telegraph networks, in view of investigating inter-state cooperation within the *Deutsch-Österreichischer Telegraphen-Verein* which was

⁴ J. L. Kieve, *The Electric Telegraph: A Social and Economic History* (Newton Abbot, 1973). A recent addition is S. Fari, *Victorian Telegraphy before Nationalization* (Basingstoke, 2015).

⁵ C. Bertho, *Télégraphes et téléphones: De Valmy au microprocesseur* (Paris, 1981); The literature on other European countries is also relatively sparse: cf., for instance, in the Swedish context: *Svenska Telegrafverket: en historisk framställning, utgiven enligt beslut av Kungl. Telegrafstyrelsen*, ed. Kungl. Telegrafstyrelsen (7 vols., Stockholm, 1931-97); For Italy, see U. Cavina, *La Telegrafia Elettrica e le Origini del Morse (Uffici e linee nell'Italia preunitaria)* (Albino, 2008).

⁶ H. A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland und die rheinische Industrie: von den Anfängen bis zum Ausbruch des Ersten Weltkrieges* (Wiesbaden, 1983).

founded in 1850.⁷ Both authors tie the subject into broader economic and political issues, but their accounts remain very much confined to the questions they have identified.

Other histories are scattered and regionally inflected, due to the geopolitical division of Germany when the technology was introduced in the 1850s. Often, details must still be sought in the various *Jubiläumsschriften* which were issued in the early twentieth century upon the anniversaries of each state's postal or telegraph network.⁸ A number of articles and book chapters otherwise provide useful starting points for exploring the intellectual, political or literary facets of this technology, but remain disparate.⁹ This thesis will serve in part to rectify these lacunae.

The decontextualisation of telegraphy is particularly acute in those histories focusing specifically upon its technical origins.¹⁰ This is despite now long-standing efforts by some historians of science and technology to explore the external factors which shaped the artefacts and theories which they study. The 'Social Construction of Technology' (SCOT) propounded in the 1980s, for instance, has spurred a broadening

⁷ J. Reindl, *Der Deutsch-Österreichische Telegraphenverein und die Entwicklung des deutschen Telegraphenwesens, 1850-1871* (Frankfurt am Main, 1993); See also: J.-O. Hesse, *Im Netz der Kommunikation: Die Reichs-Post und Telegraphenverwaltung, 1876-1914* (Munich, 2002) – Hesse's account focuses on the period following that covered by this thesis.

⁸ See, for example: *Rückblick auf das erste Jahrhundert der K. Bayer. Staatspost (1. März 1808 bis 31. Dezember 1908)*, ed. K. B. Staatsministerium für Verkehrsangelegenheiten (Munich, 1909); F. Weber, *Post und Telegraphie im Königreich Württemberg: Denkschrift aus Anlass des Ablaufs der fünfzigjährigen Verwaltung des württembergischen Post- und Telegraphenwesens durch den Staat* (Stuttgart, 1901); *Hundert Jahre Telegraphie in der Pfalz, 1853-1953*, ed. Oberpostdirektion (Neustadt, 1953).

⁹ For instance, M. Wobring, 'Telekommunikation und Nationsbildung. Die politischen Konzepte früher deutscher Telegraphenplanung vom ausgehenden 18. Jahrhundert bis zur Paulskirche', *Technikgeschichte* 71, no. 3 (2004), pp. 201-221; W. Löser, 'Die Rolle des Preußischen Staates bei der Ausrüstung der Eisenbahnen mit elektrischen Telegraphen in der Mitte des neunzehnten Jahrhunderts', *Jahrbuch Für Wirtschaftsgeschichte*, 4 (1963), pp. 193-208; B. Siegert, *Relays: Literature as an Epoch of the Postal System* (Stanford, 1999), esp. pp. 165-85.

¹⁰ K. Beauchamp, *History of Telegraphy* (London, 2001) – a posthumous publication, very much in the vein of traditional histories of technology; A. Huurdeman, *The Worldwide History of Telecommunications* (Hoboken, NJ, 2003); In German, see V. Aschoff, *Geschichte der Nachrichtentechnik* (2 vols., Berlin, 1995), ii.; A much earlier work, E. Feyerabend, *Der Telegraph von Gauss und Weber im Werden der elektrischen Telegraphie* (Berlin, 1933) provides a very brief summary of early developments, and reproduces a number of crucial documents which, it seems, have since been lost.

of the discipline, and attempts to reveal the inner workings in the ‘black box of technology’, but these efforts have not been applied to telegraphy.¹¹ In a parallel move, for the past three decades Bruno Latour has been advocating a new sociology of science, one which exposes the ‘Janus-faced’ nature of science. Behind the ‘discoveries’ which are presented to the public as coherent systems, he argues, lies an intricate flow of ideas which inevitably penetrates the laboratories in which they are developed.¹²

The historiography of science has since provided fascinating insights into the ‘enrolment’ of numerous actors in the elaboration of objects and ideas, which feed back into the cultures in which they are produced.¹³ Drawing inspiration from these approaches, this thesis focuses upon the electric telegraph in Germany in order to reveal the connections between the social, economic and political contexts in which it was developed.

The first section, consisting of three chronologically structured chapters, explicitly foregrounds the context in which telegraphy was developed during the 1830s and 1840s. It focuses upon the scientists, engineers, entrepreneurs, political economists, and bureaucrats drawn from across Germany who contributed, in one way or another, to the vision and materialisation of electrical telegraphy. The interests and expectations which these actors brought to the technology helped determine the course of its development, just as the disciplines, professions and political or economic concepts with which they worked were shaped by their very engagement in the process.

¹¹ W. E. Bijker, T. P. Hughes, and T. J. Pinch (eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, Mass, 1987).

¹² B. Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Milton Keynes, 1987), esp. pp. 1-17.

¹³ J. Golinski, *Making Natural Knowledge: Constructivism and the History of Science* (Chicago, 2008), esp. pp. 13-46.

These chapters highlight the cross-fertilisation which took place between different sections of society at this time, including state representatives, making clear the artificiality of the distinction between science and technology which still dominates approaches to the period of early industrialisation in Germany.¹⁴ Rejecting the anachronistic categorisation of telegraphy as a product of these two fields, it emphasises the broad nature and widespread availability of knowledge at the time and highlights the related struggle which took place to define areas of competence, expertise and enterprise.

The use of telegraphy, on the other hand, has been approached from a wide variety of perspectives in the secondary literature. In keeping with the tradition established by Knies, it has become a staple in histories of the media, replete with narratives leading ‘from Gutenberg to the Digital Age’, in which the nineteenth century witnessed a purported ‘communications revolution’.¹⁵ Other historians have used telegraphy as a case study to compare different state practices in the management of infrastructure.¹⁶ Meanwhile, Daniel Headrick listed telegraphy as one of his principal ‘tools of empire’, foreshadowing the technology’s role in globalisation, a subject which

¹⁴ U. Wengenroth, ‘Science, Technology and Industry’, in D. Cahan (ed.), *From Natural Philosophy to the Sciences: Writing the History of Nineteenth-Century Science* (Chicago, 2003), pp. 221-53.

¹⁵ B. Kovarik, *Revolutions in Communication: Media History from Gutenberg to the Digital Age* (London, 2011), esp. pp. 255-74; Further examples include: J. Bray, *Innovation and the Communications Revolution: From the Victorian Pioneers to Broadband Internet* (London, 2002); T. Standage, *The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century’s Online Pioneers* (London, 1999); B. Winston, *Media, Technology and Society: A History: From the Telegraph to the Internet* (London, 1998). The concept of a communications revolution is often traced back to the Canadian historians Harold Innis and Marshall McLuhan, who emphasised the transformative impact of media upon society. Cf., for example, H. A. Innis, *The Bias of Communication* (Toronto, 1951); H. M. McLuhan, *The Gutenberg Galaxy: The Making of Typographic Man* (Toronto, 1962). For a critical evaluation of the concept, see W. Behringer, ‘Communications Revolutions: A Historiographical Concept’, *German History*, 24, no. 3 (2006), pp. 333-74.

¹⁶ E. Sax, *Die Verkehrsmittel in Volks- und Staatswirtschaft* (2 vols., Vienna, 1878-9); R. Millward, *Private and Public Enterprise in Europe: Energy and Telecommunications, 1830-1990* (Cambridge, 2005), pp. 59-75.

has recently aroused considerable interest.¹⁷ The cultural approach to telegraphy has also provided new insights on the Victorian imagination, spiritualism and its impact on literature, among other subjects.¹⁸ This thesis not only adds the rather neglected context of Germany to the field, but also highlights how many of these different uses and understandings of the telegraph emerged in parallel.

The second section of this thesis tackles these issues in three chapters covering the period between 1850 and 1880. Here, it is the ‘consumers’ of the technology who take centre stage, from state administrators, ministers, and members of parliament, to news agencies, bankers, merchants and manufacturers. The technical development of the telegraph continued during this period, of course, and many actors - the state in particular - straddled the border between ‘production’ and ‘consumption’. In these chapters, the focus is upon the ways in which actors negotiated their different understandings of the telegraph as a component of the media, as a tool of policing and state administration, as a support for new structures of finance, or as a means of communication in increasingly global networks of trade and industry. Whilst focusing upon Germany, therefore, this thesis explores the interaction of forces exerted from a local to a global level.

Both in its origins and development, telegraphy was evidently tied into the bundle of concepts, processes and actors commonly associated with ‘modernity’, from science, technology and industrialisation, to state formation, colonialisation, globalisation and the communications revolution. Indeed, telegraphy’s eventually global reach seems to

¹⁷ D. R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (Oxford, 1981); R. Wenzlhuemer, *Connecting the Nineteenth-Century World: The Telegraph and Globalization* (Cambridge, 2012). Wenzlhuemer’s overview suggests a number of directions which the historiography might fruitfully follow, and has spurred some interesting studies: see n. 89 and 90.

¹⁸ For instance, J. Stolow, *Deus in Machina: Religion, Technology, and the Things in between* (New York, 2013).

epitomise the kind of triumphalist onward march of Western technological progress during the nineteenth century described in David Landes' paradigmatic *Unbound Prometheus*.¹⁹ As will be explored below, however, these narratives and categories have faced an onslaught of deconstruction and rectification in the literature, leaving a putative modernity in poor shape.²⁰

Germany's position in this narrative of Western progress, moreover, has long been coloured by the tenets of a *Sonderweg* thesis seeking to explain the country's disastrous turn in the 1930s. Well before the rise of Nazism, it is true, the writings of Georg Simmel and then Oswald Spengler had taken a critical view of modernity.²¹ But the 'German Catastrophe' then set historiography itself on a different path, which has since struggled to accommodate apologias of technological development. To Georg Mosse, for instance, it was a rejection of modernity, with all its technological apparel, and the desire to recover an imagined organic and 'natural' past which characterised Germany's fateful divergence from the West.²²

For others, it was in fact an excessive exposure to the effects of industrialisation and urbanisation, the unhealthy acceleration of the pace of life which, by the end of the nineteenth century, had set the country on an unstable course. Joachim Radkau's *Zeitalter der Nervosität*, for instance, illustrated the purported crisis of German society and its nervous descent into political turmoil by exploring the rising concern for the

¹⁹ D. Landes, *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present* (Cambridge, 1969).

²⁰ For an overview of the many different possible directions of the term, see F. Cooper, 'Modernity', in *Colonialism in Question: Theory, Knowledge, History* (Berkeley, 2005), pp. 113-49.

²¹ G. Eley, J. Jenkins and T. Matysik, 'German Modernities and the Contest of Futures', in G. Eley, J. Jenkins and T. Matysik (eds.), *German Modernities from Wilhelm to Weimar: A Contest of Futures* (London, 2016), pp. 1-30; G. Simmel, 'Die Großstädte und das Geistesleben', in T. Petermann (ed.), *Die Großstadt. Vorträge und Aufsätze zur Städteausstellung* (Dresden, 1903), pp. 185-206.

²² G. Mosse, *The Crisis of German Ideology* (New York, 1964).

psychological effects of excessive stimulation in the modern era.²³ The theme has been taken up by others, and more recently it has been argued that anxieties regarding the effects of modernity upon the human will were a defining feature of German culture in the late-nineteenth and early twentieth centuries.²⁴ As the example of the telegraph will illustrate, however, Germany experienced both the elation and the anxieties associated with technological progress, the fulfilment of its promises and the discovery of its unexpected consequences - these it certainly shared with its Western counterparts.²⁵

This thesis argues that the multiplicity, complexity, and even incoherence which recent historiography has revealed in the narrative of modernisation were at its very heart. Adapting Bruno Latour's terminology, it suggests that the 'hybridity' of modernity was epitomised by the telegraph: the technology was the product of multiple actors who had become dependent upon one another's resources, but who simultaneously sought to assert the distinctiveness of their contributions to its development.²⁶ Once in operation, the telegraph itself came to enhance this interdependence between people and places, but it was manifested in parallel processes of aggregation and fragmentation in society. In a Heideggerian sense, it was not merely used by, but came to 'enframe' the experience of modernity as interdependence.²⁷ Reaching beyond the immediate origins of the telegraph, therefore, reveals its roots in

²³ J. Radkau, *Das Zeitalter der Nervosität: Deutschland zwischen Bismarck und Hitler* (Munich, 1998) .

²⁴ A. Killen, *Berlin Electropolis: Shock, Nerves, and German Modernity* (London, 2006); M. Cowan, *Cult of the Will: Nervousness and German Modernity* (University Park, PA, 2008).

²⁵ D. Blackbourn, *The Long Nineteenth Century: A History of Germany, 1780-1918* (New York, 1998), pp. 270-310.

²⁶ B. Latour, *Nous n'avons jamais été modernes: essai d'anthropologie symétrique* (Paris, 1991), esp. pp. 1-45. Latour describes the 'proliferation of hybrids', objects which are increasingly difficult to describe as either 'natural' or 'socially constructed' as a characteristic of advanced modernity, which some choose to describe as 'post-modernity'. This difficulty, he argues, derives from the artificiality of the division between the 'natural' and the 'social' in the first place - two categories which were distinguished over the course of the scientific revolution during the sixteenth and seventeenth centuries, and which have become a part of our 'modern constitution'.

²⁷ M. Heidegger, 'The Question Concerning Technology', in *The Question Concerning Technology and Other Essays*, transl. W. Lovitt (London, 1977), pp. 3-36.

changing social relations and concepts of communication. This thesis adopts a chronological structure so as to trace the thread represented by telegraphy in this unfolding of modernity.

The many different actors under consideration in this thesis were driven by a variety of motivations. The quest for scientific authority or financial security, visions of nation-state integration, engagement in pan-European and global trade, local prestige, and liberal economic thought all played into the expectations raised by the prospect of telegraphic communication. The individuals and groups representing these different ambitions were therefore not only brought together, but also brought into conflict and negotiation as they engaged with telegraphy. Their moods oscillated as a result of these interactions, rising and falling, expressing ‘the feeling of what happens’ when they engaged in developing or using the technology, symptoms of the interdependence to which they were subjected by modernity.²⁸

Naturally, the desire to include as diverse a selection of protagonists as possible imposed some limitations on the choice of material under investigation. This thesis cannot therefore claim to provide an exhaustive study of telegraphy in Germany. Indeed, to do so would be to defy the very principle upon which it is based: that the origins and consequences of telegraphic communication cannot be confined to a single locality, state, or set of actors. It is nonetheless based upon extensive archival research in state, municipal, and corporate archives throughout the country, in addition to which a number of published journals, pamphlets and textbooks from the period have been consulted.

²⁸ A. Damasio, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (New York, 1999).

Where the actions of a particular state are under consideration, it is the Kingdom of Bavaria which features most prominently, on the basis of research conducted in the Bayerisches Hauptstaatsarchiv. The choice is deliberate, insofar as it seeks to counterbalance the emphasis traditionally placed on Prussia, for which more literature on telegraphy already exists, whilst Bavaria still represented a state of considerable weight in the course of German history. Once again, however, it also reflects the broader point which this thesis seeks to make, regarding the development of a technology which was derived from a broadly circulating knowledge, and whose most avid initial users did not necessarily operate according to established borders.

In order to account for regional and local differences in development, further research was also conducted at the Staatsarchiv Bremen and the Archiv der Handelskammer Bremen; at the Staatsarchiv Nürnberg and Stadtarchiv Nürnberg; at the Landesarchiv Nordrhein-Westfalen in Duisburg, and the Stadtarchiv Wuppertal. The private correspondence of Carl Steinheil and Werner Siemens was consulted at the archive of the Deutsches Museum and the Siemens Corporate Archives in Munich, respectively. Some additional primary material was also kindly provided by the Institut für Stadtgeschichte in Frankfurt am Main. Drawing upon these sources and a selection of published texts, this thesis is intended to offer a representative picture of developments in nineteenth-century Germany as a whole.

Telegraphy did not impose itself wholesale upon state and society, rather it was incorporated and moulded by its developers and users according to their understandings of the changing world around them, and their struggles over expertise and access to communication. Returning to Heinrich Schellen's expression, the 'tangle' of telegraphy derived from the many different threads of actors and interests involved in its

development. This thesis emphasises the ‘thick strands of continuity’ of history from which these threads unravelled and intertwined anew during the nineteenth century.²⁹

The Context of Communication and Social Change

The great proponent of history over the *longue durée*, Fernand Braudel, wrote that ‘the value of an innovation is only ever proportional to the social transformation which supports and imposes it’.³⁰ The principle holds true insofar as the concepts and practices which shaped telegraphic communication in nineteenth-century Germany can be traced back to the evolution of social relations in Western and Central Europe beginning in the sixteenth century. During the ensuing period, new concepts of state and society emerged to describe these changing relations, attributing an increasingly important role to exchange, communication, or the characteristically equivocal German ‘*Verkehr*’. This long-term change in the theory and reality of communication, this thick strand of continuity, underpins the history of telegraphy traced in this thesis.

From its origins, telegraphy was conceptualised in terms which reflected existing understandings of long-distance communication and the technologies which supported it. As an object, it was the product of a related change in the landscape of science and technology, and as a tool, from the mid-nineteenth century onwards it too came to shape the concept and practice of communication. Following Wolfgang Behringer, therefore, we might argue that telegraphy was one facet of a much longer ‘communication revolution’ which he traces back to the early modern period, and the establishment of

²⁹ The expression is drawn from H. W. Smith, *The Continuities of German History: Nation, Religion, and Race Across the Long Nineteenth Century* (Cambridge, 2008), p. 12, who uses it to illuminate the related but different context of historiographical debates on the German *Sonderweg*.

³⁰ Quoted in P. Flichy, *Une histoire de la communication moderne: Espace public et vie privée* (Paris, 1991), p. 2 - my translation.

the *Reichspost* in Central Europe.³¹ From that time, European society fell prey to a ‘tempo virus’ which encouraged the pursuit of ever more rapid forms of communication, and of which the oft-mentioned ‘media revolutions’ of the nineteenth and twentieth centuries are merely further symptoms.³²

The religious upheavals which shook Europe in the sixteenth and seventeenth centuries, and particularly the devastation inflicted upon the German-speaking lands during the Thirty Years’ War, altered the relationship between rulers and their subjects. With the rise of the territorial state, however contested both by contemporaries and historians, a new abstract source of power emerged whose authority was wielded over a distinct space and population. The efforts of Louis XIV in France, Elector Friedrich Wilhelm in Prussia and Ferdinand III in Austria to subjugate the provincial sources of power underpinning the feudal order produced new attitudes to the management of the people and resources now under their direct authority. Where ‘Mercantilism’ is commonly used to describe these practices in England and France, its counterpart in German-speaking Central Europe was ‘Camerarism’.

The coherence of Cameralism in theory and practice is disputed, but its many variations during the seventeenth and eighteenth centuries reveal a widespread, underlying understanding of society and nature as distinct spheres of activity which could be measured, regulated and exploited by the state. From Veit von Seckendorff’s *Teutscher Fürstenstaat* in 1656, to Johann Gottlob von Justi’s *Staatswirthschaft* in 1758, individual writers advised rulers with their descriptions of ideal states in which both natural and human resources were rationally managed.

³¹ W. Behringer, *Im Zeichen des Merkur: Reichspost und Kommunikationsrevolution in der Frühen Neuzeit* (Göttingen, 2003), pp. 643-88.

³² P. Borscheid, *Das Tempo-Virus: eine Kulturgeschichte der Beschleunigung* (Frankfurt, 2004), pp. 149-79.

Their methods were increasingly taught at educational institutions, such as the universities of Göttingen and Heidelberg, or the *Bergakademie* in Saxon Freiberg, and newly trained government administrators were deployed to state provinces to produce topographies, introduce principles of forestry, and begin ‘model’ manufactures.³³ Landscapes, always objectified to a degree by human activity, were no longer transformed as a result of ad hoc local schemes, but as part of rulers’ planned attempts to colonise new spaces.³⁴ In short, territories and populations were rendered ‘legible’ for the purposes of economic exploitation.³⁵

To be sure, many of Germany’s principalities and cities remained immune to the encroachment of centralising state power of the Prussian kind, protected as they were by the ‘incubator’ of the Holy Roman Empire.³⁶ Moreover, the quantity of ink spilt on the ‘ordering’ of states, may well suggest just how disordered they were in reality.³⁷ Nonetheless, the wide distribution of Cameralist literature, its progressive anchoring in the universities, and its implementation by numerous rulers highlight the developing ambition to describe and manage the relations between nature, society and the state.

Within this framework, the ‘common good’ or ‘*das allgemeine Wohl*’ was used by theorists and administrators to describe the shared fate of state and society. In the seventeenth century, Johann Joachim Becher’s understanding that ‘state and economy

³³ D. Lindenfeld, *The Practical Imagination: The German Sciences of State in the Nineteenth Century* (Chicago, 1997), pp. 11-45; G. Stavenhagen, *Geschichte der Wirtschaftstheorie* (Göttingen, 1969), pp. 15-35; cf. P. R. Rössner, ‘New Inroads into Well-Known Territory? On the Virtues of Re-Discovering Pre-Classical Political Economy’, in P. R. Rössner (ed.), *Economic Growth and the Origins of Modern Political Economy: Economic Reasons of State, 1500-2000* (London, 2016), pp. 3-25.

³⁴ D. Blackbourn, *The Conquest of Nature: Water, Landscape, and the Making of Modern Germany* (New York, 2006), esp. pp. 21-76.

³⁵ J. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, 1999), pp. 9-84.

³⁶ M. Walker, *German Hometowns: Community, State and General Estate, 1648-1871* (Ithaca, 1971), pp. 11-33.

³⁷ As argued by Andre Wakefield in *The Disordered Police State: German Cameralism as Science and Practice* (Chicago, 2009).

(*Wirtschaft*) constitute a single economic entity' still prevailed, but his expression also suggests that they denoted separate concepts. By the eighteenth century, the distinction between the state and the set of social and economic interactions which it could seek to regulate had become clearer.³⁸ *Verkehr* was increasingly understood as the force behind those interactions, and what was eventually to be conceptualised as a dynamic, independent economic sphere, a theme which was pursued well into the nineteenth century, and which will be explored in this thesis.

Indeed, communication and transport were intrinsically related to the transformation of the post-Westphalian territorial state, particularly in Central Europe. Until the seventeenth century, the *Heer-* and *Handelsstraßen* connecting the myriad cities and principalities of the region had been under the authority of the Holy Roman Empire, whilst smaller roads were managed by a mixture of territorial lords, communities and private owners. The *Reichspost*, meanwhile, was run almost exclusively by the Thurn & Taxis family, to which Emperor Frederick III had granted a monopoly in 1443. After the peace of Westphalia, however, the Elector of Brandenburg established his own *Landespost* in 1649 and others soon followed suit.³⁹ By the eighteenth century, a number of states had also taken on the responsibility of constructing new, paved roads (*Kunststraßen*, or *Chausseen*).⁴⁰ Development was variegated, of course, but the principle of state involvement in the provision of communications infrastructure had been established.

For Cameralist writers, roads and postal services were among the state monopolies, or *Staatsregalien*, which local princes were to wrest from the Holy Roman

³⁸ Stavenhagen, *Geschichte der Wirtschaftstheorie*, pp. 15-35; Lindenfeld, *Practical Imagination*, pp. 11-45.

³⁹ Behringer, *Im Zeichen des Merkur*, pp. 240-79, here: p. 243.

⁴⁰ K. G. A. Jeserich, H. Pohl and G.-C. von Unruh (eds.), *Deutsche Verwaltungsgeschichte* (5 vols., Stuttgart, 1983-8), ii., 204-8.

Emperor.⁴¹ As Justi argued in the mid-eighteenth century, however, roads were to be built ‘not just for travellers’ and their goods, but such that ‘every man can enjoy sufficient security on them’.⁴² It was increasingly in this public interest that states undertook to construct new *Chausseen*.⁴³ Moreover, Justi also claimed that ‘[t]he revenue is, as with all monopolies, only a secondary aim of the postal system’.⁴⁴ In 1737, a pathbreaking ‘*Intention*’ published in Baden declared roads to be of utility to all subjects, not merely its principal users, thereby acknowledging the function of exchange within society as a whole.⁴⁵ By the late eighteenth century, the concept of ‘*Verkehr*’ had thus extended beyond its original definition as the execution of commercial and direct social transactions.⁴⁶ But in practice a mixture of local and central authority persisted, fees were still imposed on many *Chausseen*, and the public nature of roads would only be codified by the middle of the nineteenth century.⁴⁷ The relationship between state, society, ‘*allgemeine Wohl*’ and *Verkehr* remained the subject of debate.

Similar re-evaluations of the purpose of exchange and communication were taking place across Europe. In Britain, an intellectual undercurrent reaching back to Thomas Hobbes and John Locke led Adam Smith to place the individual, human propensity for exchange at the heart of his *Wealth of Nations*, published in 1774. In France, the Physiocrats, called for the removal of barriers to the exchange of goods within a territory – ‘*laissez-faire*’ emerged as a source of wealth. In Germany, by the 1790s Jung-Stilling saw private economy as a sector independent of and prior to public policy, and thus worthy of independent study. The ‘common good’, he believed, derived from

⁴¹ Behringer, *Im Zeichen des Merkur*, pp. 216-40.

⁴² J. H. G. von Justi, *Staatswirthschaft, oder systematische Abhandlung aller Oeconomischen und Cameralwissenschaften* (2 vols., Leipzig, 1755), ii., 131.

⁴³ Jeserich, Pohl and von Unruh (eds.), *Deutsche Verwaltungsgeschichte*, ii., 206-8.

⁴⁴ Justi, *Staatswirthschaft*, ii., 160.

⁴⁵ Jeserich, Pohl and von Unruh (eds.), *Deutsche Verwaltungsgeschichte*, ii., 206.

⁴⁶ J. Ritter (ed.), *Historisches Wörterbuch der Philosophie* (13 vols., Darmstadt, 1971-2007), xi., 703-4.

⁴⁷ Jeserich, Pohl and von Unruh (eds.), *Deutsche Verwaltungsgeschichte*, ii., 218-9.

the needs of individuals.⁴⁸ As Armand Mattelart has argued, the modern meaning of ‘communication’ derived from these widespread efforts to conceptualise the relationship between individuals, societies and exchange.⁴⁹

By the late 1700s, therefore, the economic function of *Verkehr* within society was accepted, but it was understood as a system of interactions across a network of stable relations. Adam Smith himself had believed in a ‘balance’ of trade between nations, and the French Physiocrats asserted that an ‘*ordre naturel*’ underpinned exchanges within society. In Germany, the great classifier, Johann Beckmann, still relied upon a mechanistic metaphor to describe the ideal state, a system regulated by the smooth dovetailing of its cogs, but which left little room for dynamism or growth.⁵⁰

The upheavals of the early nineteenth century shook, but did not disrupt this line of continuity. Naturally, the Napoleonic wars and the collapse of the Holy Roman Empire in 1803, along with the new states and reforms which they prompted throughout Germany, stimulated new visions and constructions of society, state and exchange. Following the Congress of Vienna, for instance, the political salience of the idea of the ‘the nation’ grew, whilst the dynasties placed at the head of patchwork states sought to bring their territories together in spirit and in reality.

Communications infrastructure received renewed attention and political significance as a result, but the policies adopted in the first decades of the nineteenth century did not differ radically from those pursued since the seventeenth century. Rather, they were given new meaning. In Prussia, the construction of roads which had

⁴⁸ Lindenfeld, *Practical Imagination*, pp. 34-6.

⁴⁹ A. Mattelart, *L'invention de la communication* (Paris, 2011).

⁵⁰ Lindenfeld, *Practical Imagination*, p. 28.

been neglected by Frederick the Great was reprised.⁵¹ The monopoly of states such as Bavaria over postal services was officially sanctioned, and these became a major source of revenue.⁵² The road and canal-building projects to link the Rhine, Main and Danube in Bavaria became a symbol of the Wittelsbach dynasty's benevolence towards all its subjects, new and old.⁵³ The 'taming of the Rhine' by Johann Gottfried Tulla, begun in the cameralist spirit, now became an instrument of state-building for the newly formed Grand Duchy of Baden.⁵⁴ Transport and communication were thereby improved, but their ultimate purpose remained the intrinsic alignment of state and society.

In conceptual terms, the role of *Verkehr* as an economic force in society was only slowly being emancipated from the state-centred theories of the Cameralist era. On one hand, the fundamental principles of a 'classical' economics derived from Adam Smith's work were slowly incorporated by German writers. Supported by the diffusion of Natural Law theory and Kantian philosophy, the individual was increasingly placed at the heart of economic thought. Works such as J.F.E. Lotz's *Der Verkehrende Mensch* (1821), and Heinrich Rau's *Lehrbuch der politischen Ökonomie* placed the satisfaction of human needs and desires at the core of a new German style of *Nationalökonomie*, and *Verkehr* between individuals became the principle means by which this was achieved.⁵⁵

On the other hand, the universalism associated with natural law and Smithian economics, and the emphasis which these placed upon the autonomous realm of social interaction, clashed with prevailing notions regarding the primacy of the state. The most

⁵¹ Jeserich, Pohl and von Unruh (eds.), *Deutsche Verwaltungsgeschichte*, ii., 206.

⁵² K. Amtmann, *Post und Politik in Bayern von 1808 bis 1850: Der Weg der königlich-bayerischen Staatspost in den Deutsch-Österreichischen Postverein* (Munich, 2006), pp. 230-44.

⁵³ N. Mayr, 'Particularism in Bavaria: State Policy and Public Sentiment, 1806-1906' (University of North Carolina PhD Thesis, 1988), p. 85.

⁵⁴ Blackbourn, *Conquest of Nature*, p. 94.

⁵⁵ K. Tribe, *Governing Economy: The Reformation of German Economic Discourse, 1750-1840* (Cambridge, 1988), pp. 149-201.

radical rejection of these theories came from Adam Müller, who believed that ‘Man is inconceivable outside the state’, and laid the foundations for a historical, organic conception of state and society which has come to be seen as characteristically German.⁵⁶ Müller’s ideas were only truly influential much later in the century, however, and for the most part a tension prevailed into the 1840s between the freedom of economic interaction, and the higher purposes of the state. As David Lindenfeld has argued, the works of Hegel, Friedrich List and Robert von Mohl, display efforts to merge the desire for order inherited from their Cameralist predecessors with their acknowledgment of the self-propelling dynamism of society.⁵⁷

The position occupied by telegraphy within this historical tangle of concepts and practices is traced throughout both sections of this thesis. Indeed, its role as a means of communication placed it at the heart of discussions regarding the relationship between the individual, society and the state. Not only List and Mohl, but later also Karl Knies, as well as parliamentary deputies espousing liberal principles, and even state officials approached new technologies such as the telegraph with this heritage of ideas concerning the functions of communication and *Verkehr*. In some respects, the technology was comparable to the roads, railways, and waterways being developed around the same time, but in other ways, it was characterised by certain technical and material peculiarities, and by the particular uses to which it was put. Forging relations of interdependence as it connected individuals within and beyond German states, it came in turn to change their understanding of communication itself.

⁵⁶ Tribe, *Governing Economy*, p. 175.

⁵⁷ Lindenfeld, *Practical imagination*, p. 93.

The Process of Innovation

Against this backdrop of changing concepts and practices of communication, the first section of this thesis traces the emergence of electrical telegraphy within the ‘landscape of innovation’ in Europe, which had itself been transformed over the preceding centuries. On one hand, the Cameralists’ interest in manufacturing and agriculture had opened up a field of ‘technology’, in which production methods were catalogued, disseminated, discussed in social circles, and taught in academic institutions. On the other hand, the empirical research upon which ‘modern science’ depended became detached from its mooring in the academies spread across Europe, but as yet struggled to find a foothold in the universities. From the late eighteenth century into the 1840s, therefore, both ‘scientific knowledge’ and ‘know-how’ gained broader social and institutional salience, supported by a booming journal culture, and enabling a wide array of people across Germany to engage in technological development.

Indeed, the ‘producers’ of the telegraphy who feature in this thesis are diverse. They range from the renowned Göttingen professor and mathematician Gauß, the Munich-based academician Carl August Steinheil, through a number of lowly or anonymous contributors to polytechnical or specialist journals, to ambitious entrepreneurs such as Werner Siemens, railway magnates, military commissions, bureaucrats, and even private associations. Together with others in Germany and beyond, these individuals helped to create the apparatuses, explain the underlying electrical phenomena, develop the cable technology, and solve the problems associated with electrical telegraphy.

Yet the interdependence, and at times unwitting collaboration of these different actors in producing the technology is rarely acknowledged. It points to some of the

difficulties confronted in the historiography of industrialisation, which has variously foregrounded ‘science’, ‘technology’, the state, the private sector and even natural resources as the principal contributor to the process. There is a long scholarly tradition emphasising the role of the state in German industrialisation, for instance. Often focusing upon Prussia, this literature spotlights the legal and administrative framework provided by the state, its creation of educational institutions and support for enterprise, and the demand it generated for businesses, in seeking to remedy its perceived backwardness vis-à-vis the West.⁵⁸ Research on particular regions, meanwhile, has led to indications that private investment was decisive even within Prussia - in the Rhineland, for instance, - or that the state was equally influential in Baden.⁵⁹

More recently, historians have demonstrated that the categories of state and private enterprise are too rigid to be assigned wholesale responsibility for the process of industrialisation. As James Brophy has shown, railway construction in Prussia involved considerable interaction between businessmen and bureaucrats, and Eric Brose has demonstrated that factions and coalitions within state departments defied the elaboration of a monolithic policy of technological innovation.⁶⁰ Building upon these insights, this thesis spotlights the interdependence between the diverse actors providing the logistical, financial and technical resources necessary to the development of telegraphy.

⁵⁸ W. Fischer, ‘Das Verhältnis von Staat und Wirtschaft in Deutschland am Beginn der Industrialisierung’, *Kyklos*, 14, no. 3 (1961), pp. 337-63; W. O. Henderson, *The State and the Industrial Revolution in Prussia, 1740-1870* (Liverpool, 1958); U. P. Ritter, *Die Rolle des Staats in den Frühstadien der Industrialisierung* (Berlin, 1961); I. Mieck, *Preussische Gewerbepolitik in Berlin, 1806-1844* (Berlin, 1965); H.-U. Wehler perceived the state’s role as merely establishing a framework which did not hinder industrial development, *Deutsche Gesellschaftsgeschichte* (5vols., Munich, 1987-2008), ii., 64-94.

⁵⁹ R. Tilly, *Financial Institutions and Industrialization in the Rhineland, 1815-70* (London, 1966); W. Fischer, *Der Staat und die Anfänge der Industrialisierung in Baden, 1800-1850* (Berlin, 1962).

⁶⁰ J. M. Brophy, *Capitalism, Politics, and Railroads in Prussia, 1830-1870* (Columbus, 1998); E. D. Brose, *The Politics of Technological Change in Prussia: Out of the Shadow of Antiquity, 1809-1848* (Princeton, 1993).

Borrowing from Joel Mokyr, it argues that a broadly conceived ‘useful knowledge’ circulated among the people and institutions concerned and supported their collaborative efforts.⁶¹ Using this concept, Peter Jones has revisited the production revolution which took place in late eighteenth and early nineteenth century Britain, arguing for an ‘industrial Enlightenment’ rather than the primacy of either ‘science’ or ‘know-how’. Most recently, he has applied the same idea to the ‘agricultural Enlightenment’ which took place across Europe between 1750 and 1840, and together these works suggest how the broad diffusion of knowledge was able to effect change, without pinning credit (or responsibility) upon a single actor.⁶²

Adopting this concept is by no means to dilute any notion of agency and causality into a maelstrom of ideas. The form which the circulation of knowledge took reflected the specific constellation which had emerged between German academies, universities, and associations during the early nineteenth century, and which made the interdependence of social actors particularly visible. The same stock of knowledge, moreover, was progressively channelled into different forums and journals, adopted by scientists, technicians, entrepreneurs and bureaucrats for different purposes.

‘Useful knowledge’, indeed, had been at the heart of Cameralist efforts to regulate society. Techniques drawn from mining, forestry and agriculture, for instance, had been collected, catalogued and tested, and in 1777 Johann Beckmann promoted ‘*Technologie*’ as the umbrella term referring to the knowledge useful to the trades and manufactures.⁶³ The production techniques identified by Beckmann, Justi, and others were also taught as part of the *Cameralwissenschaften*, and the trend set by the

⁶¹ J. Mokyr, *The Gifts of Athena: Historical Origins of the Knowledge Economy* (Oxford, 2002), pp. 1-27.

⁶² P. Jones, *Industrial Enlightenment: Science, Technology and Culture in Birmingham and the West Midlands, 1760-1820* (Manchester, 2009), *Agricultural Enlightenment: Knowledge, Technology and Nature, 1750-1840* (Oxford, 2016).

⁶³ Lindenfeld, *Practical Imagination*, p. 32.

University of Göttingen continued into the early nineteenth century. During the early 1800s, for instance, the great Bavarian reformer Montgelas introduced the subject to the universities of Ingolstadt (later Landshut) and then Würzburg. Whilst Cameralism itself slowly gave way to the *Staatswissenschaften* as the century progressed, *Technologie* had nonetheless received institutional recognition.⁶⁴

Scientific research, on the other hand, had been progressively detached from its own institutional context. To begin with, eighteenth-century universities had provided neither the expectation of, nor incentives for empirical research. The philosophical faculties in which mathematics and *Naturwissenschaften* were taught constituted a mere preparation for the higher faculties, particularly that of medicine. Instead, since the mid-seventeenth century, empirical research and discussion had revolved around the numerous European academies or societies of science. In Germany, the academies in Berlin, Munich and Göttingen featured prominently as forums for the ‘Republic of Letters’ in which science was often a central topic of exchange. By the latter decades of the eighteenth century, however, these academies were in decline, and were dealt a harsh blow by the disruptions of the French revolution.⁶⁵ Academies and researchers lived on in Germany, but the knowledge they produced was no longer anchored in their institutions.

In parallel, opportunities multiplied for the circulation of ‘useful knowledge’ across a broader social spectrum. From the mid-1700s, government efforts to improve agriculture and manufacture were matched by the appearance of numerous ‘patriotic’ or

⁶⁴ Lindenfeld, *Practical Imagination*, p. 52.

⁶⁵ J. McClellan, *Science Reorganized: Scientific Societies in the Eighteenth Century* (New York, 1985), pp. 233-59.

‘economic’ societies throughout Germany.⁶⁶ Reflecting trends in Enlightenment sociability, their members included nobles, merchants, tradesmen, and state officials who came together, often upon a private initiative, to discuss improvements to agriculture and manufacturing in their town or region. Following the example set in England, the *Gesellschaft zur Beförderung der Künste und nützlichen Gewerbe* was established in Hamburg in 1765, and similar societies emerged in Karlsruhe and Neuötting-Burghausen in provincial Bavaria in the 1760s, Lübeck in 1788-9, Nuremberg in 1792, until they could be found across Germany.

This pattern continued into the early nineteenth century, leaving old and new sites of knowledge production scattered across Germany. The discussion of ‘galvanism’, or electricity, took place between these hubs, as yet unassigned to a particular discipline or institution. Wilhelm von Humboldt’s reforms were slow to spread the ideal of research to the natural sciences, and only by the 1840s would physics as a discipline gain a firmer foothold at the universities. Even the future eminence, Georg Ohm, whose ground-breaking theory of electricity was published in 1827, was unable to find fixed employment at a research institution. After leaving Cologne, he taught at the *Vereinigte Artillerie- und Ingenieur-Schule* in Berlin, unsuccessfully applied for a position at the Bavarian *Akademie der Wissenschaften*, and found himself teaching at the Nuremberg *Polytechnische Schule* during the 1830s.⁶⁷

Caught between declining academies and rising universities, empirical research in physics thus took place in a variety of settings, whilst modern science as a whole still

⁶⁶ H. Lowood, *Patriotism, Profit and the Promotion of Science in the German Enlightenment: The Economic and Scientific Societies, 1760-1815* (New York, 1991); H. E. Bödeker, 'Economic Societies in Germany, 1760-1820: Organisation, Social Structures and Fields of Activities', in K. Stapelbroek and J. Marjanen (eds.), *The Rise of Economic Societies in the Eighteenth Century* (Basingstoke, 2012), pp. 182-211.

⁶⁷ C. Jungnickel & R. McCormmach, *Intellectual Mastery of Nature: Theoretical Physics from Ohm to Einstein* (2 vols., Chicago, 1986), i., 52-8.

struggled in the face of persistent claims from a pervasive, idealistic, romantic philosophy of life, or *Naturphilosophie*.⁶⁸ Indeed, one of the movement's leading figures, Wilhelm Joseph Schelling, headed the *Naturwissenschaftliche Sammlung* of the Bavarian academy from which Ohm had been rejected. The academy, at which Carl Steinheil was to pursue his research in electrical telegraphy in the 1830s, assumed various functions during the period, at times providing the teaching normally expected of a university, and later sharing its research cabinet with the new University of Munich, established in 1826.⁶⁹

The competition inherent in a decentralised university system, highlighted by Joseph Ben-David, was therefore only one element in the flourishing of scientific research in Germany.⁷⁰ Academies, economic societies, and peripatetic professors played a crucial role in the dissemination of ideas throughout the country. With the exception of Gauß, who refused to leave Göttingen after 1828, figures such as Georg Ohm, Wilhelm Weber and Carl Steinheil taught and researched in a variety of institutions, from the military schools of Berlin, to the *Gymnasien*, *Polytechnische Schulen*, universities and academies spread out across Germany.

Alongside the natural sciences, the *Technologie* which had gained entry into the universities as part of the *Cameralwissenschaften* was disseminated through a widening array of institutions. In the eighteenth century, state engineers had been trained at institutions based on the model of the French *Ecole des Ponts et Chaussées*, such as the *General-Wegbau-Intendance* established in Hanover in 1764 or the *Bauakademie*

⁶⁸ R. Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago, 2002).

⁶⁹ Jungnickel & McCormmach, *Intellectual Mastery*, 266-84; L. Boehm, 'Das akademische Bildungswesen in seiner organisatorischen Entwicklung (1800-1920)', in M. Spindler (ed.), *Handbuch der Bayerischen Geschichte* (4 vols., 1967-75), iv., 1008-17.

⁷⁰ J. Ben-David, *The Scientist's Role in Society: A Comparative Study* (Englewood Cliffs, 1971), pp. 108-138.

founded in Berlin in 1799.⁷¹ Beginning in 1821, Christian Peter Wilhelm Beuth then established 20 new *Gewerbeschulen* in Prussia, whose students were trained in a number of trades, and some of whom would attend the *Gewerbe-Institut* established in Berlin.⁷² Outside Prussia too, similar considerations led to the establishment of *Polytechnische Schulen* in Karlsruhe (1825) and Hanover (1831), for instance.⁷³ Even ‘backward’ Bavaria sought to stimulate new methods of production, with the *Polytechnische Centralschule* founded in Munich in 1827, which spawned similar institutions in Augsburg and Nuremberg.⁷⁴

As Georg Ohm’s employment record illustrates, there was considerable transfer of knowledge and expertise across the spectrum of academies, universities and technical institutions. Beyond these educational establishments, moreover, the heritage of Enlightenment economic and patriotic societies fed into the ‘polytechnical societies’ created in the nineteenth century. Depending on the region, these societies displayed varying degrees of connection to the state, but all brought together individuals from a broad cross-section of society to share their interest and expertise in their chosen field of technology. The most famous was the *Verein zur Förderung des Gewerbefleißes in Preussen*, established under the aegis of Beuth in Berlin. In parallel to this state-sponsored association, there also emerged the far more independent *Polytechnische Gesellschaft* established privately in 1839 by Nathan Mendelssohn and J.C. Freund.⁷⁵

Similar associations were to be found across Germany, and even the Bavarian ‘*Agriculturstaat*’ displayed signs of public interest in innovation. A private initiative led

⁷¹ L. U. Scholl, *Ingenieure in der Frühindustrialisierung: staatliche und private Techniker im Königreich Hannover und an der Ruhr (1815-1873)* (Göttingen, 1978), pp. 55-64; P. Lundgreen, *Techniker in Preussen während der frühen Industrialisierung: Ausbildung und Berufsfeld einer entstehenden sozialen Gruppe* (Berlin, 1975), p.12.

⁷² Lundgreen, *Techniker in Preussen*, pp. 45-54.

⁷³ Scholl, *Ingenieure*, 245-6.

⁷⁴ L. Boehm, ‘Das akademische Bildungswesen’, p. 1025.

⁷⁵ I. Mieck, *Preussische Gewerbepolitik in Berlin, 1806-1844* (Berlin, 1965), pp. 36, 162.

to the founding of the *Polytechnische Gesellschaft* in Würzburg in 1807, an *Industrie- und Kulturverein* emerged in Nuremberg in 1819, and a *Polytechnischer Kreisverein* in Augsburg, the two latter towns constituting the state's centres of trade and manufacture.⁷⁶ The Munich *Polytechnischer Verein* was established in 1816, and given the high proportion of its members who were officials, it effectively acted as a patent office, assessing the feasibility and utility of new inventions on behalf of the government – a reminder that the state too participated in this circulation of knowledge.⁷⁷

The term 'polytechnic' itself highlights the importance placed on the broad scope of issues discussed in these societies. They often brought together craftsmen and manufacturers, with chemists (*Apotheker*) and even some professors, and could thereby provide crucial social connections and training for the many *Handwerker* who found themselves on an open labour market with the progressive removal of guild regulations, preparing the ground for the professional associations which proliferated from mid-century. The societies also played a central role in the emerging culture of industrial exhibitions through which ideas about technology were diffused. In 1809, the Würzburg *Polytechnische Gesellschaft* held quite possibly the first German '*Kunst- und Industrie-Ausstellung*', followed by the Munich *Polytechnischer Verein*'s own *Gewerbeausstellung* in 1817, and many more across Germany – most notably that organised by Beuth's *Verein* in Berlin in 1822.⁷⁸

Whilst exhibitions only slowly took on supra-local dimensions, new publications simultaneously emerged which ensured that ideas and innovations could be circulated throughout Germany and beyond. *Dinglers Polytechnisches Journal*, which will be

⁷⁶ S. Fisch, 'Polytechnische Vereine im "Agricurstaat" Bayern bis 1850', *ZBLG*, 49 (1986), pp. 539-78.

⁷⁷ D. E. Thomas, 'Der Polytechnische Verein in Bayern (1816-1933)', *ZBLG*, 64 (2001), pp. 431-460.

⁷⁸ Fisch, 'Polytechnische Vereine', p. 543; Mieck, *Preussische Gewerbepolitik*, pp. 141-9.

examined in this thesis, was founded in 1820 in Augsburg for this very purpose, and became a key channel for British and French ideas to enter the German states. Journals were simultaneously replacing textbooks as the principal means of communicating research among academics. *Poggendorffs Annalen der Physik und Chemie* for instance, developed into the principal organ for the discussion of physics and electricity between 1800 and 1830, and its contributors reflected the shifting institutional basis of science, with roughly half attached to universities, and the other half being academicians.⁷⁹ There was considerable crossover between the two forms of journal too. *Dinglers*, for instance, regularly translated and published material from academic *Comptes Rendus*, within Germany and beyond. An entrepreneur such as Werner Siemens, meanwhile, though trained as an artilleryman, was no stranger to the *Annalen der Physik*.⁸⁰

The actors who feature most prominently in the first three chapters of this thesis were all located at different sites in this broad landscape of innovation during the 1830s and 1840s. From Gauß in Göttingen, to Carl Steinheil in Munich or Johan Schmidt in Bremen, from Werner Siemens in Berlin to Rhenish railway companies and Bavarian state bureaucrats, all approached telegraphy from different angles, but came to depend upon the resources which each could provide and a common fund of knowledge circulating between them. The new connections which could be forged between such diverse institutions and social actors reflected changes which were much broader than industrialisation alone, and which characterised Germany's 'great transition' to a new

⁷⁹ Jungnickel & McCormach, *Intellectual Mastery*, p. 37.

⁸⁰ H. Pieper, 'Werner von Siemens und die elektrotechnische Fachliteratur bis 1872', *Technikgeschichte*, 34 (1967), pp. 323–49.

economic order.⁸¹ Their interactions and exchanges enabled new combinations of forces which were at the heart of both the hopes and frustrations of the modern age.

The Impact of Telegraphy

From mid-century, telegraphy in turn became a force in the transformation of social relations in Germany and beyond. Whilst the work of the technology's producers continued in the background, the purposes and needs of communication now came to the fore, and these will be the focus of the second part of this thesis. No longer a mere idea, the telegraph now began to shape the many different local, regional, national and even global communities which were being reconfigured during the second half of the nineteenth century. Facilitating exchanges across a range of distances, the technology fuelled the socio-economic transformations which were the result of growing interdependence between people and places. Promising instantaneous communication, it allowed individuals and communities to interact more closely; failing to fulfil that promise, it created tensions between them.

Although they are often mentioned in the same breath, railways, rather than the telegraph, are the revolutionary innovation most directly associated with the shaping of new communities during the nineteenth century. Karl Deutsch's *Nationalism and Social Communication* famously highlighted the role of infrastructures of communication in supporting processes of national integration, and allowed a little space for the discussion of telegraphy in his account.⁸² Eugen Weber, meanwhile, whose *Peasants into*

⁸¹ J. M. Brophy, 'The End of the Economic Old Order: the Great Transition, 1750-1860', in H. Walser Smith (ed.), *The Oxford Handbook of Modern German History* (Oxford, 2011), pp. 169-94.

⁸² K. Deutsch, *Nationalism and Social Communication: An Inquiry into the Foundations of Nationality* (London, 1953), pp. 95-6.

Frenchmen remains the classic illustration of Deutsch's theory in a historical context, mentions the technology only in passing, and the neglect has persisted ever since.⁸³ This thesis seeks to fill the void created by the focus on telegraphy's more imposing sibling, and to enrich our understanding of German nation-state integration by considering how the peculiarities of this particular technology impacted upon it.

The telegraph was in many ways the silent partner of the railways, with which it became closely associated from the 1840s onwards. The earliest telegraph lines were often laid by railway companies as a means of signalling and coordinating the passage of trains. For practical reasons, moreover, once individual states took on the task of establishing telegraph networks, railways provided a natural channel along which land had already been expropriated, and wires could be laid. On the other hand, given the smaller levels of investment they required, telegraph lines were often also then built ahead of railway lines and beyond them. The technology also differed in obvious ways in the type of communication which it offered – notably, a dematerialised form of messaging.

Whilst the telegraph may be placed in parallel to the railways, however, recent research has also clearly shown that the impact of communications networks on processes of state-integration was variegated. In particular, Abigail Green has demonstrated that for the period between the 1848 revolutions and German unification, railways contributed to a dual process of nation-building, enhancing allegiances to both the particularist states and the broader German fatherland.⁸⁴ Even following unification, as Siegfried Weichlein has shown, railways and postal networks contributed to the

⁸³ E. Weber, *Peasants into Frenchmen: The Modernization of Rural France, 1870-1914* (Stanford, 1976), pp. 219-20.

⁸⁴ A. Green, *Fatherlands: State-Building and Nationhood in Nineteenth-Century Germany* (Cambridge, 2001).

enhancement of both regional and national (imperial) loyalties.⁸⁵ Transport and communication, these works suggest, were by no means incompatible with the now well documented persistence of local and regional identities in Germany.⁸⁶ This thesis will argue that telegraphy sustained a number of communities, many of which cut across the boundaries of the states or the *Kaiserreich*, far more than the railways ever could.

Indeed, the global reach of the telegraph has won it a much more prominent role in histories of supra-national transformations during the nineteenth century. Daniel Headrick's work placed it among the fundamental 'tools of empire' which connected metropole and colony, and emphasised its role in transforming the conduct of international relations.⁸⁷ Most recently, it is in the historiography of globalisation that the telegraph has experienced a revival of interest, undoubtedly related to contemporary concerns over the nature and role of telecommunications in the age of the internet.⁸⁸ The spread of telegraph networks worldwide also brought to light the importance of new, global actors by whom they were constructed and operated. From the large corporations undertaking the installation of submarine cables to the new large-scale monopolies established by news agencies and press associations, telegraphy quite literally connected nations, empires and global business ventures.⁸⁹

New research, however, has once again emphasised the variegated impact of telegraphic communication when considered at an imperial and even global scale. Using

⁸⁵ S. Weichlein, *Nation und Region: Integrationsprozesse im Bismarckreich* (Düsseldorf, 2004).

⁸⁶ For example, C. Applegate, *A Nation of Provincials: The German Idea of Heimat* (Berkeley, 1990); A. Confino, *The Nation as a Local Metaphor: Württemberg, Imperial Germany, and National Memory, 1871-1918* (London, 1997).

⁸⁷ D. R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (Oxford, 1981); D. R. Headrick, *The Invisible Weapon: Telecommunications and International Politics, 1851-1945* (Oxford, 1991); see also D. P. Nickles, *Under the Wire: How the Telegraph Changed Diplomacy* (Cambridge, MA., 2003) and P. Hugill, *Global Communications since 1844: Geopolitics and Technology* (London, 1999).

⁸⁸ Wenzlhuemer, *Connecting the Nineteenth-Century World*.

⁸⁹ S. M. Müller, *Wiring the World: The Social and Cultural Creation of Global Telegraph Networks* (New York, 2016).

the example of colonial India, Amelia Bonea has explored the complexity of the relationship between telegraphy and journalism, on the one hand, and demonstrated the difficulty of reducing its impact to simple relations of power and subordination.⁹⁰ Simone Müller, meanwhile, has focused on the men and women behind the ‘wiring of the world’ by submarine cable laying companies, highlighting the ways in which they operated both within and between the national contexts in which they were anchored. Müller has also made clear the problematic nature of the visions and reality of ‘global’ communication in the nineteenth century as the product of an Euro-American worldview, and in terms of the contrasts which it enhanced between those included or excluded from the network.⁹¹

In short, at national, imperial and global levels of analysis, the picture is fragmented. Everywhere, the putative homogenising power of communications networks contrasts with the plethora of actors involved in its development, the numerous parallel transformations which it fuelled, and the many different communities which it sustained. The second section of this thesis foregrounds this tangled reality, demonstrating that the telegraph inherently divided as much as it connected.

The impact of telegraphy was intimately related to its social and economic functions. The telegraph, indeed, fuelled both industrialisation and the emergence of market capitalism across Europe. In this respect, the introduction of telegraphy invites us once again to reconsider the notion of a ‘failed bourgeois revolution’ in Germany between 1850 and 1900, suggesting that it in fact constituted another facet of the ‘silent

⁹⁰ A. Bonea, *The News of Empire: Telegraphy, Journalism and the Politics of Reporting in Colonial India, c. 1830-1900* (Oxford, 2016).

⁹¹ Müller, *Wiring the World*.

bourgeois revolution' described by David Blackbourn.⁹² Taking this argument beyond national boundaries, this thesis suggests that the telegraph provided concrete infrastructural support for the 'networks of means' which Jerrold Seigel has described as the primary characteristic of the modern European bourgeoisie, supplying it with administrative, professional and financial resources.⁹³ As time wore on, moreover, the pool of the technology's users grew, and it became entwined with the very process of industrialisation from which it had emerged.

Just as networks became increasingly globally accessible, however, so they also became even more firmly embedded in the local settings where telegraph offices were situated. As a vehicle for industrialisation and market capitalism, therefore, the telegraph accentuated the transformation of local environments effected by these forces.⁹⁴ As Oliver Zimmer has demonstrated for the later nineteenth century, it is in engaging with very concrete local issues, such as theatres and schools, or the organisation of religious and national celebrations, that the broader politics of national identity formation were played out.⁹⁵ In a similar way, this thesis will argue, conflicts over the positioning of telegraph offices highlighted the social differentiation taking place within municipalities, as different strata of the population sought access to the service. The social variegation of communicative practices themselves eventually became a matter for discussion in Reichstag during the 1870s, as telegraphy came full

⁹² D. Blackbourn and G. Eley, *The Peculiarities of German History: Bourgeois Society and Politics in Nineteenth-Century Germany* (Oxford, 1984), esp. pp. 176-205.

⁹³ J. Seigel, *Modernity and Bourgeois Life: Society, Politics and Culture in England, France, and Germany since 1750* (Cambridge, 2012), esp. pp. 1-37.

⁹⁴ On the impact of broader socio-economic and political forces upon local communities, see W. Whyte & O. Zimmer (eds.), *Nationalism and the Reshaping of Urban Communities in Europe, 1848-1914* (Basingstoke, 2011).

⁹⁵ O. Zimmer, *Remaking the Rhythms of Life: German Communities in the Age of the Nation-State* (Oxford, 2013).

circle and influenced the concepts of communication and society from which it had emerged.

Whilst telegraphy simultaneously brought together and distinguished communities, time, it is argued here, came to underpin them. Together with railway transportation, telegraphy undeniably also altered conceptions of space, the two dimensions being related in what David Harvey referred to as ‘time-space compression’.⁹⁶ But where the telegraph differed fundamentally from its more boisterous partner, was in its dematerialisation of communication. Space may have contracted as a result and, as we shall see, perceptions of distance certainly became important. But in the first instance, telegraphy enabled interlocutors to converse instantaneously without displacing themselves, it allowed for the coordination of clocks and the establishment of homogenous time zones, and thus for individuals to regulate their interactions according to a shared temporal framework.

Or so it seemed. The impact of technology upon conceptions of time during the nineteenth century has recently been revisited. David Landes’ classic work, *Revolution in Time*, had placed the history of the clock at the centre of ‘what we call modern civilisation’, as the tool which enabled the coordination of activities, the division of labour, and ultimately, capitalism.⁹⁷ E. P. Thompson also famously associated the discipline necessary to industrial capitalism with the introduction of clocks in factories.⁹⁸ These earlier works posited the progressive triumph of abstract, rational ‘clock time’ over the vagaries of medieval ‘natural’ or biological understandings of

⁹⁶ D. Harvey, *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change* (Cambridge, Mass., 1990), p. 240.

⁹⁷ D. Landes, *Revolution in Time: Clocks and the Making of the Modern World* (Cambridge, Mass., 1983).

⁹⁸ E. P. Thompson, ‘Time, Work-Discipline, and Industrial Capitalism’, *Past & Present*, 38 (December 1967), pp. 56–97.

time.⁹⁹ Recent work, however, has questioned this paradigm, driven particularly by the motivations of post-colonial historiography to investigate the related assumption that ‘modern’ time measurement emerged in the West alongside capitalism.

On Barak has foregrounded the telegraph as one of the technologies which nominally imposed ‘Western’ time management in colonial Egypt. His research shows, however, that time was infused with different meanings, and that a variety of ‘times’ could co-exist in such a setting.¹⁰⁰ Taking a global view of developments, Vanessa Ogle has similarly shown that, from the late-nineteenth to the mid-twentieth century, the ideal of a ‘universal’ time struggled to find a footing across the world, and in fact provided a framework in which other conceptions of social, religious, and ‘national’ times could be defined.¹⁰¹ Like the national, imperial and global contexts explored in the historiography, then, time has itself been fragmented.

This thesis engages with these findings, and seeks to further them in two ways. First, it explores the relationship between telegraphy and time, which is still remarkably understudied in the literature on the European context.¹⁰² Second, it argues that not only did a similar fragmentation in conceptions of time to that witnessed in colonial settings occur in Germany, but that this temporal fragmentation in fact accentuated the process of social differentiation evoked earlier. Inclusion and exclusion from telegraph networks was one means of distinguishing between individuals, groups and states, but both within and outside these networks, differences in the speed of communication enhanced those distinctions.

⁹⁹ On the different layers of temporal experience and modes of measuring time, see B. Adam, *Time and Social Theory* (Cambridge, 1990).

¹⁰⁰ O. Barak, *On Time: Technology and Temporality in Modern Egypt* (Berkeley, 2013).

¹⁰¹ V. Ogle, *The Global Transformation of Time: 1870-1950* (Cambridge, MA, 2015).

¹⁰² With a few exceptions, such as: R. Wenzlhuemer, “‘Less Than No Time’. Zum Verhältnis von Telegrafie und Zeit”, *Geschichte und Gesellschaft*, 37, no. 4 (October, 2011), pp. 592–613; I. R. 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 (December, 2000), pp. 455–75.

These observations offer a corrective to certain assumptions about the ‘culture of time and space’ which purportedly emerged at the turn of the century. Stephen Kern’s work provides a wonderful example of how historians might begin to describe collective cognitive changes in society, by illustrating the effect of new technologies upon perceptions of time and space, but it resorts to rather sweeping generalisations.¹⁰³ By focusing on the turn of the century, and the perceived accumulation of modern, mentally straining technologies at that juncture, his account too easily elides the subtle ways in which technology progressively infiltrated society. By exploring the earliest stages of telegraphy’s implementation and use, this thesis traces its adoption by different groups, and the more insidious ways in which it created and divided communities.

Indeed, it was in many ways the contrast between the regularity and homogeneity of time which technologies such as the telegraph promised and the real, often material limitations to that ideal which gave time its potency. Already in the eighteenth century, as Michael Sauter has demonstrated, the emergence of a ‘clockwatching’ public in Berlin, which gathered to check their watches by the astronomical clock, had created clear distinctions between the different times available throughout the city.¹⁰⁴ As Oliver Zimmer has suggested in the context of Imperial Germany, in more discreet ways too, different *perceptions* of speed and time could provide the framework in which to articulate visions of community, associating them with the various ‘rhythms’ of municipal life.¹⁰⁵ The broad brushstrokes of a modern culture of time and space concealed a much more diverse reality.

¹⁰³ S. Kern, *The Culture of Time and Space, 1880-1918* (Cambridge, Mass., 2003).

¹⁰⁴ M. J. Sauter, ‘Clockwatchers and Stargazers: Time Discipline in Early Modern Berlin’, *American Historical Review*, 112, no. 3 (Jun., 2007), pp. 685-709.

¹⁰⁵ Zimmer, *Remaking the Rhythms*, pp. 171-292.

Between 1849 and 1880, a number of communities were thus created, reinforced or divided, by their use of the telegraph. Towns, individual states, and after 1870, the Kaiserreich, were only a few of these. By enabling communication across a whole spectrum of distances, the telegraph also sustained communities which cut across these more common categories of analysis. As a result, different users' habits of communication at varying distances were played out in local settings, just as the balancing of small-scale and global communication became an issue of debate in the Reichstag. Having been promised access to modern, instantaneous communication as members of a municipality, state, nation, trading network, or media outlet, in actuality users found themselves excluded or included, behind or ahead in relation to others.

*

Telegraphy thus tied Germany into the Western experience of modernity, complete with its many ambiguities. Like its neighbours, Germany was subject to the celebrated benefits of technological progress as well as the disruptions caused by its onward march, as has only recently been emphasised.¹⁰⁶ From the process of its development to its widespread integration, the telegraph was the product of, and a contributor to the growing interdependence of people and places. It lay at the heart of the connections and divisions, the hopes and disappointments of modernity.

¹⁰⁶ G. Eley, J. L. Jenkins and T. Matysik, 'Introduction: German Modernities and the Contest of Futures', in G. Eley, J. L. Jenkins and T. Matysik (eds.), *German Modernities from Wilhelm to Weimar: A Contest of Futures* (London, 2016), pp. 1-30; Y.-S. Hong, 'Neither Singular nor Alternative: Narratives of Modernity and Welfare in Germany, 1870-1945', *ibid.*, pp. 31-58; G. Eley, 'What was German Modernity and When?', *ibid.*, pp. 59-82.

Part I: The Process of Innovation, c. 1830-1849

Chapter One: Expectations

‘The speed with which the telegraph transmits information borders on the incredible’, the political scientist Robert von Mohl remarked in 1832.¹ His colleague at the University of Tübingen, Johann Poppe, was in agreement. In a textbook published in 1834, the professor of *Technologie* asserted that ‘foremost among the many subjects which presently excite the public’s interest to a high degree are the railways and the telegraph, which one can also indisputably count among the most remarkable inventions of recent times’.² Three years later, in his entry for the essay prize competition administered by the French Academy of Sciences, Friedrich List similarly asserted that ‘the telegraph is one of the most important discoveries of the human genius. It proves how much nature strives to unite and to bring humanity closer together, and the degree to which it is possible for man to overcome the obstacle which distances pose to nature’s aims’.³

All three authors evoked the terms of a now familiar discourse on technological progress which is closely associated with the nineteenth century. To this day, speed, human ingenuity, public interest, and the conquest of distance continue to characterise the ‘communications revolution’ whose roots are often identified in steam power, railways and telegraphy. Yet Mohl, Poppe and List were not referring to the electric

¹ R. v. Mohl, *Die Polizei-Wissenschaft nach den Grundsätzen des Rechtsstaates* (2 vols., Tübingen, 1832-3), ii., 395.

² J. H.M. Poppe, *Die Telegraphen und Eisenbahnen* (Stuttgart, 1834).

³ F. List, *Die Welt bewegt sich. Über die Auswirkungen der Dampfkraft und der neuen Transportmittel...*, ed. Eugen Wendler (Göttingen, 1985), p. 156.

telegraph which has come to feature centrally in this narrative, rather to its less celebrated predecessor, the optical, or signal telegraph.⁴

The enthusiasm which these writers expressed towards what was soon to be considered an obsolete technology points to an underlying interest in matters of communication, and to the relativity inherent in perceptions of speed and progress. Reaching further back, for instance, one encounters reports marvelling at the speed of the ‘flying courier’ in the mid-sixteenth century, or of the post-riders of Kurbrandenburg in the 1650s.⁵ As David Edgerton has emphasised, the enduring influence of existing technologies is often obscured by our excessive concern with the novelty of inventions.⁶ Whilst the optical telegraph would in fact soon disappear from the European landscape, it had stimulated discussions and enriched the existing discourse on the nature and purpose of long-distance communication for both state and society.

It was not only intellectuals who drew upon this conceptual heritage, however. Recent historiography has shown that modern innovations such as the electric telegraph not only stimulated the contemporary imagination – the literature and spiritualism of the nineteenth century are a testimony to the cultural impact of electricity, for example - but were themselves shaped by such visions.⁷ In this regard, scholars in media and cultural

⁴ There is some uncertainty as to whether or not Friedrich List may indeed have known about or foreseen the development of the electric telegraph: Cf. E. Wendler, *Friedrich List (1789-1846): A Visionary with Social Responsibility* (Berlin, 2015), p.194. Given his interest in the construction of the Leipzig-Dresden railway, whose board of directors briefly considered trialling the new technology in the 1830s, it is possible that he had this in mind. As the text in question was addressed to the French Academy, however, it is likely that he was describing the optical telegraph which was best known in Europe at the time. See below, pp. 43-7.

⁵ W. Behringer, *Im Zeichen des Merkur: Reichspost und Kommunikationsrevolution in der Frühen Neuzeit* (Göttingen, 2003), pp. 644-5.

⁶ D. Edgerton, *The Shock of the Old: Technology and Global History since 1900* (Oxford, 2007).

⁷ Cf. R. Menke, *Telegraphic Realism: Victorian Fiction and Other Information Systems* (Stanford, 2008); J. Stolow (ed.), *Deus in Machina: Religion, Technology and the Things in Between* (New York, 2013); On the role of the imagination in shaping technology, see M. Sturken, D. Thomas and S. Ball-Rokeach (eds.), *Technological Visions: The Hopes and Fears That Shape Technologies* (Philadelphia, 2004).

studies have come closer to historians of technology who emphasise the influence of the social context and the role of users in ‘co-constructing’ technologies.⁸ Even before consumers enter the scene, however, the questions, images, and potential benefits evoked by writers such as Mohl, Poppe and List have the power to attract interest and stimulate the development of new ideas among scientists and entrepreneurs.

By the 1830s, this chapter argues, broad assumptions as to the aims of telegraphy had become widespread. Together, these assumptions fostered expectations in the technology’s potential to enhance existing means of communication. They opened up a horizon of possibilities for intellectuals, scientists, technicians, bureaucrats and businessmen alike, supported by widely circulating knowledge on the topic. These shared expectations provided the leitmotif for their engagement with the technology, as each contributed to the knowledge, logistics and finance necessary for its materialisation.

The power of expectation as a socio-economic force was recognised in the 1960s by the proponents of an emerging field of behavioural economics. Seemingly ‘rational’ subjects, they had found, acted irrationally in the markets, often ignoring a product’s ‘fundamentals’ in favour of its reputation. In the 1970s, Nathan Rosenberg applied the idea to the study of technological innovations, helping to explain the fluctuations and irregularities in overly schematic models of their adoption and diffusion, of the kind proposed by Everett Rogers.⁹ Only recently, the function of such ‘irrational’

⁸ N. Oudshoorn and T. Pinch (eds.), *How Users Matter: The Co-Construction of Users and Technology* (Cambridge, Mass., 2005).

⁹ N. Rosenberg, *Inside the Black Box: Technology and Economics* (Cambridge, 1982); E. Rogers, *Diffusion of Innovations* (New York, 1962).

motivations in attracting contributors to the production process itself has come under closer scrutiny.¹⁰

As will be highlighted below, the terms in which the promise of telegraphic communication was couched were sufficiently broad and ambitious as to draw together a large cast of actors. It was a belief in the possibilities rather than the realities of long-distance communication which thereby enrolled the people and resources necessary to its materialisation. Each one of the actors in question then drew upon the fluid concept of ‘telegraphy’ and gave it new qualities, envisioned its different purposes, and proposed ways of bringing it to life. This malleable concept, or ‘boundary object’, thereby provided a common focal point around which the actors could negotiate their interest in the matter.¹¹

Indeed, whilst the ultimate goal lay on the distant horizon, the experimentation, planning, and financial investment involved required a more rational assessment of the individual steps which had to be taken. It is precisely the growing gulf between the ‘space of experience’ and the horizon of rapidly advancing expectations in the modern era which required ever greater collaboration in reaching that goal.¹² As the 1830s wore on, scientists, technicians, bureaucrats and businessmen were forced to shift their focus away from their long-term aims, recognising their dependence upon the material or intellectual resources of others. Confronting the different interests which coalesced around the telegraph, their expectations often turned into frustration.

¹⁰ Cf. M. Borup, N. Brown, K. Konrad and H. van Lente, ‘The Sociology of Expectations in Science and Technology’, *Technology Analysis and Strategic Management*, 18, nos. 3 and 4 (Jul.-Sep. 2006), pp. 285-98.

¹¹ S. L. Star and J. R. Griesemer, ‘Institutional Ecology, “Translations”, and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907-39’, *Social Studies of Science*, 19, no. 3 (Aug., 1989), pp. 387-420.

¹² R. Koselleck, “‘Erfahrungsraum’ und “Erwartungshorizont” – zwei historische Kategorien’, R. Koselleck, *Vergangene Zukunft. Zur Semantik geschichtlicher Zeiten*, 4th edn. (Frankfurt am Main, 2000), pp. 349-75.

The Horizon of Telegraphic Communication

In a reflection of persisting trends in the historiography of Germany, studies of early electric telegraph networks tend to focus primarily on the state.¹³ Unlike the railways, which were characterised by a complex mixture of private and public ownership throughout the century, from the 1840s to the 1860s telegraphy reflected a neat demarcation separating Europe's continental proponents of state monopoly, France and Germany, from its haven of private enterprise, the United Kingdom.¹⁴ In France, the state's monopoly over the construction (and initially, use) of telegraph networks was enshrined in a law of 1837, and a similar stance was eventually adopted throughout most of Germany. Despite the state's undeniable role in the process, however, this focus marginalises the broader discussions in which it participated alongside scientists, entrepreneurs, and intellectuals, without whom the technology would never have been developed.¹⁵

Michael Wobring, for instance, has drawn a line of continuity between attitudes to optical and electrical telegraphy in Germany, both of which he believes were dominated by the state. Beginning in the 1810s, Wobring claims, military-strategic considerations aroused the Prussian government's interest in optical telegraphy, laying the foundations for its future control over the construction and expansion of all similar networks through

¹³ J. Reindl, *Der Deutsch-Österreichische Telegraphenverein und die Entwicklung des deutschen Telegraphenwesens, 1850-1871* (Frankfurt am Main, 1993); H. A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland und die rheinische Industrie: von den Anfängen bis zum Ausbruch des Ersten Weltkrieges* (Wiesbaden, 1983), pp. 15-244.

¹⁴ R. Millward, *Private and Public Enterprise in Europe: Energy, Telecommunications and Transport, 1830-1990* (Cambridge, 2005).

¹⁵ Horst A. Wessel does however consider the different companies involved in the production of the materials for the states' telegraph lines: see Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens*, esp. pp. 207-44.

to the mid nineteenth century - save for a short period during the 1830s, during which railway construction was prioritised. According to Wobring, whose analysis derives almost entirely from the Prussian case-study, despite the numerous economic motivations for improving telecommunications, these played no determining role in their development.¹⁶

In a parallel article, he extends this argument to the intellectual sphere, drawing on remarkably few sources scattered across the period 1790 to 1840, to conclude that, throughout Germany, telegraphy was viewed primarily and persistently from the political standpoint of state integration.¹⁷ Yet the continuity which Wobring defines begins and ends with the state, and primarily the Prussian state at that. With a perspective clearly directed towards the central questions of the German *Sonderweg* thesis (despite situating itself in a narrative of 'globalisation'), it neglects the other directions in which telegraphy was being pulled at the time.¹⁸

Indeed, by the 1830s, the various optical telegraph systems established across Europe had fuelled ongoing discussions on the function of communication and its technologies in both state and society. Although a number of semaphoric networks had been recorded throughout history, it was in the 1790s that the Frenchman Claude Chappe developed the simple mechanical contraption which would be adapted and implemented in a number of countries. His optical telegraph consisted of three connected slats of wood, mounted atop any small building or structure at an elevated

¹⁶ M. Wobring, *Die Globalisierung der Telekommunikation im 19. Jahrhundert: Pläne, Projekte und Kapazitätsausbauten zwischen Wirtschaft und Politik* (Frankfurt am Main, 2005), pp. 93 – 140.

¹⁷ M. Wobring, 'Telekommunikation und Nationsbildung: Die politischen Konzepte früher Deutscher Telegrafenplanung vom Ausgehenden 18. Jahrhundert bis zur Paulskirche', *Technikgeschichte* 71 (2004), pp. 201–22.

¹⁸ Helmut W. Smith has elegantly demonstrated the capacity for historical focal points to direct scholars' attention towards or away from particular fields of inquiry, especially with regard to the *Sonderweg* in the historiography of Germany: see, H. W. Smith, 'The Vanishing Point of History', in *The Continuities of German History: Nation, Religion, and Race Across the Long Nineteenth Century* (Cambridge, 2008), pp. 13–38.

point in the landscape, and which could be articulated from within an office established beneath it. Telegraphists operated the machine to form certain prescribed symbols which were observed by telescope at the next station, then relayed onwards to the message's destination.

Chappe was by no means the first to propose such a system, but in 1793 the French Convention nationale granted him 6,000 Francs to establish an experimental line in the Ile-de-France region. From 1794 onwards, during the era of the Revolutionary and Napoleonic wars, an extensive network was built throughout France, centred on Paris and reaching as far as Venice and the border with Spain.¹⁹ This period of international turmoil prompted a number of other European governments to follow the French example. From 1797 to 1808, the Admiralty in Britain established telegraphic connections between London and the country's principal ports. In Sweden, a first line had been constructed as early as 1794, and the threat of war with Russia in 1808 led the government to develop its own network. In both countries, however, the telegraph fell into disuse upon the return of peace, and only in France was a large functional network maintained throughout the early nineteenth century.²⁰

By the 1830s, some commercial telegraph lines had been built in British and American coastal towns, but the connection established in Prussia in 1832, between Berlin, Koblenz and Cologne, was certainly the most ambitious of the period. And there is no doubt that military and political motivations were important, as the technology

¹⁹ C. Bertho, *Télégraphes et téléphones: De Valmy au microprocesseur* (Paris, 1981), pp. 10-23; On the optical telegraph in northern Italy, see C. Fedele, 'Il telegrafo ottico alla sua prima apparizione in Italia', *Memorie dell'Accademia Italiana di Studi Filatelici e Numismatici*, 5, no. 3 (1994), pp. 7-14.

²⁰ Bertho, *Télégraphes et téléphones*, pp. 55-58; On the optical telegraph in Sweden, see *Svenska Telegrafverket: en historisk framställning, utgiven enligt beslut av Kungl. Telegrafstyrelsen*, vol. 3, *Den optiska telegrafens historia i Sverige, 1794-1881*, ed. N. J. A. Risberg (7 vols., Stockholm, 1931-97).

facilitated the integration of Prussia's Westphalian provinces.²¹ The influence of these diverse optical telegraph networks, however, went beyond the offices of the General Staff or of the ministerial cabinet.

As early as 1794, an 'eyewitness account' published in Germany had reported on the new Chappe telegraph system introduced in France: 'One is so convinced of the multifaceted utility of the telegraphs for the government and for commerce here, and so convinced of its almost instantaneous dissemination of information, that the Convention nationale has decided to construct telegraphs to all areas of the empire (*Reich*) [sic]'.²² Shortly thereafter, a review of this book published in *Minerva*, in Hamburg, bemoaned the fact that whilst 'the now so famous machine, [...] is being used by the French, other nations investigate whether the invention is new or old'.²³ In Hamburg itself, the long-established *Gesellschaft zur Beförderung der Künste und nützlichen Gewerbe* even received a request that such a line be built in order to connect the city to its harbour in Cuxhaven – this would provide a useful service in transmitting news of incoming and outgoing ships local businessmen.²⁴

From its very beginnings, the telegraph's potential benefits to both state and commerce were widely recognised. In 1810, for instance, Heinrich von Kleist published a short satirical piece in the *Berliner Abendblätter*, entitled '*Entwurf einer Bombenpost*'. As useful as the recent proposals for an electric telegraph might seem, he wrote, they could not provide for the transmission of long messages. In order to remedy this lacuna, he proposed establishing an artillery-powered message delivery system, involving the

²¹ K. Beyrer, 'Die optischen Telegraphie als Beginn der modernen Telekommunikation', in C. Neusch and H.-J. Teuteberg (eds.), *Vom Flügeltelegraphen zum Internet: Geschichte der modernen Telekommunikation* (Stuttgart, 1998), esp. pp. 19-26; cf. also K. Beyrer and B.-S. Mathis (eds.), *So weit das Auge reicht: Die Geschichte der optischen Telegraphie* (Karlsruhe, 1995).

²² *Beschreibung und Abbildung des Telegraphen oder der neuerfundenen Fernschreibemaschine zu Paris* (Leipzig, 1794), pp. 13-14.

²³ *Minerva: Ein Journal historischen und politischen Inhalts*, 4, no. 4 (1794), p. 383.

²⁴ *Hanseatisches Magazin*, 2 (1799), p. 299.

firing of cannon-balls filled with ‘letters, reports, attachments and packages’.²⁵ The humorous intent of Kleist’s piece relied upon and reflected a wider awareness of the possibilities for long-distance communication, and even of proposals for the application of electricity to the task.

Even Kleist’s ironic proposition placed the needs of the trading population at its core, complaining as it did that the laconic writing style required by the existing telegraph made it ‘little suited to the interests of the merchant’. He sarcastically remarked that ‘a short mathematical calculation’ would demonstrate that the proposed method of cannonball-post could facilitate communication between Berlin and Stettin or Breslau. As such, his purported proposal was ‘an invention of the greatest and most decisive weight’ in equal measure for ‘the bourgeois (*bürgerliche*) as well as commercial public’.²⁶

Whether or not the telegraph was in fact among the public’s foremost interests by the 1830s, as Johann Poppe claimed, it had become embedded in different spheres of intellectual and cultural life. The market for ‘popular science’ textbooks was only beginning to emerge at the time, but there was space to subtly captivate people’s imagination in other literary works.²⁷ Kleist’s early interest in the technology, for instance, was matched in later years by Goethe’s, who evoked in *Wilhelm Meisters Wanderjahre* the capacity for ‘the telegraphs constructed in our country, when they are

²⁵ Heinrich v. Kleist, ‘Entwurf einer Bombenpost’, *Berliner Abendblätter*, 12 Oct. 1810.

²⁶ *ibid.*

²⁷ A. Daum, *Wissenschaftspopularisierung im 19. Jahrhundert: Bürgerliche Kultur, naturwissenschaftliche Bildung, und die deutsche Öffentlichkeit, 1848-1914* (Munich, 1998), pp. 236-79; On some of the means of diffusing popular science beyond privileged circles, see J. M. Brophy, *Popular Culture and the Public Sphere in the Rhineland, 1800-1850* (Cambridge, 2007), pp. 18-53.

not otherwise damaged, [to] mark the passage of the hours by day and by night, by a very ingenious construction'.²⁸

Despite the absence of an optical telegraph network in Bavaria, the press regularly reported on news which had been transmitted abroad using the technology. Readers were familiar with the fact that 'one often sees the telegraph in movement' at times of political instability, for instance, or that a report was incomplete because 'at this point, the telegraph was interrupted by the [fall of] night'.²⁹ The technical capacities of the technology also came under scrutiny, and in 1823 the Bavarian *Kunst- und Gewerbe-Blatt* reported the French telegraph network's average transmission times.³⁰ By 1831, the performance of a new steam engine was being measured against the ideal of 'telegraphic speed'.³¹

This general awareness of the possibilities of telegraphy, alongside contemporary concerns over communication and commerce, formed the context in which writers such as Johann Poppe, Robert von Mohl and Friedrich List set out their expectations for the technology. In his *Polizei-Wissenschaft* (1833), Mohl placed considerable weight upon the development of trade, which he believed depended upon 'the rapid transmission of information'.³² The state, he wrote, had already contributed significantly to the provision of such preconditions by developing roads and a postal service – these were the means of communication which had fallen within its purview over the course of the seventeenth and eighteenth centuries. '[B]ut there is yet another means', he continued,

²⁸ *Goethes Sämtliche Werke*, ed. K. Goedeke (36 vols., Stuttgart, 1893-6) xviii., 404; Cf. also, F. Haase, *Kleists Nachrichtentechnik: Eine diskursanalytische Untersuchung* (Opladen, 1986), pp. 162-74.

²⁹ *Allgemeine Zeitung München*, 22 May 1836, 27 Aug. 1837.

³⁰ 'Schnelligkeit der Mittheilungen durch Telegraph', *KGB*, 9 (1823), p. 116.

³¹ J. Baader, 'Anzeige einer neuerfundenen Bauart von Eisenbahnen', *D[inglers] P[olytechnisches] J[ournal]*, 41, no. 1 (1831), p. 19.

³² Mohl, *Polizei-Wissenschaft*, ii., 395.

‘which is in a position to transmit information at a much greater speed, namely the telegraph’.³³

As Mohl admitted, the speed generally attributed to the technology had led governments to express their misgivings concerning the erection of private telegraph lines. To allow these, those states feared, would threaten the ‘head-start’ (*Vorsprung*) which they might otherwise gain over society. In other words, by granting individuals the right to build and use telegraph lines, they would lose their advantage in the dissemination of information. ‘Yet why should the speed of the spread of news be feared for its impact on the peace of the state?’, he asked.³⁴ In his view, states which introduced a telegraph network would be in no worse a position than those which possessed none at all.

Mohl’s work thus reflected the ongoing shift in the conception of the relationship between state and society. His text, as its title indicated, was intended to address the conventional issues which were the focus of the *Staatswissenschaften*. The very first chapter, for instance, dealt with the ‘Concept and Purpose of the State in General’.³⁵ His aim, therefore, was not to analyse the dynamics of economic interaction, but to define precisely how the state must be structured and administered so as to fulfil its higher aims. In doing so, however, he had come to recognise the independence of economic forces and their reliance upon the freedom of communication between individuals.³⁶

As he pointed out, for instance, the speed of existing postal services and of news dissemination through the press, being publicly available, had already limited any

³³ Mohl, *Polizei-Wissenschaft*, ii., 395.

³⁴ *ibid.*

³⁵ *ibid.*, i., 3.

³⁶ On the attempt among German intellectuals to reconcile the dynamism of a self-driven economy with the administration of the state in the early nineteenth century, see K. Tribe, *Strategies of Economic Order: German Economic Discourse, 1750-1950* (Cambridge, 1995), p. 183-201.

‘advance’ which the state might possess over its citizens. He agreed, it is true, that certain limitations might be imposed, so as not to interfere with the government’s own communication needs. Given its obvious utility, however, Mohl believed that although ‘up until now only governments have established such institutions for their own purposes [...] the use of the telegraph by private persons, namely by merchants [...] seems as permissible as it is desirable’.³⁷ Without attempting to detail the inner workings of the economy, he had nonetheless highlighted the need to accept its autonomy.

The ongoing conceptual tension between the needs of the state as a whole and those of its trading population was expressed in an anonymous publication of the same year. The author’s intention was to praise the Prussian government’s decision to construct an optical telegraph line between Berlin and Cologne. On one hand, the line was seen as a means by which the government intended to reconnect the disparate regions of the body politic: ‘the utility of the state-maintained telegraph for the state itself is not insignificant [...] the telegraph in a sense makes the ruler omnipresent in his kingdom’.³⁸ On the other hand, whilst ensuring the unity of the state as a whole, the author also believed that ‘such constructions [...] are among the necessary conditions under which the industry and trade of a people can attain a desirable recovery’.³⁹ The concluding remarks went on to opine that ‘[w]ere it feasible also to send private information from one commercial town to another, to bankers, merchants and factory

³⁷ Mohl, *Polizei-Wissenschaft*, ii. 395.

³⁸ *Beschreibung der vorhandenen Telegraphen: mit besonderer Berücksichtigung des preußischen, nebst einem Vorschlage zur Verbesserung derselben* (Haunwald, 1833), p. 44.

³⁹ *ibid.*, p. 6.

owners, then much would be won for the blossoming of trade and industry, as well as for the success of judicious speculation'.⁴⁰

In 1837, Friedrich List prepared his response to the essay prize question set by the French Academy of Sciences evoked at the beginning of this chapter, on the influence of new means of transport upon the 'material economy, civil life, and the social status and power of nations'. Devoting a section to the telegraph, he set his expectations high. It was, he believed, to 'enable nations and governments to correspond and to conduct their affairs as though they were separated by only a few leagues'.⁴¹ Whilst the technology had been of great service to the state thus far, he also believed that it 'could be of immense utility if it were applied to the interests of science, of the arts, of industry, of amicable relationships [...]'.⁴²

The state, in List's vision, was to act as a guarantor of equal and secure access to information. More than the railways, he believed, the telegraph was open to abuse, and could be used to attack both governments and individuals. But this was no reason to forbid the technology's use, 'considering that the advantages which would result from it for the public good (*la chose publique*) and the general interest (*intérêt général*) would be greater than the potential inconveniences [...]'.⁴³ He therefore proposed placing telegraphy under police surveillance and to ban the use of cyphered messaging. Contemporary debates over the French law of 1837 which established the state's monopoly over the network no doubt encouraged List to assign such importance to governmental supervision, but it also reflected the close relationship between state and economy in his mind.

⁴⁰ *Beschreibung der vorhandenen Telegraphen*, p. 45.

⁴¹ List, *Die Welt*, p. 156.

⁴² *ibid.*, pp. 154-5.

⁴³ *ibid.*, p. 155.

One of the main abuses which he believed state control would prevent was that the telegraph might become ‘the instrument of illicit profits for those who might gain access to it by their fortune, or a right of precedence, or by any other privilege’. By centralising the administration of the telegraph network, equality of access would be ensured. Meanwhile, in order to provide for the ‘general interest’, List established that ‘general news, of interest both to all of commerce and all of industry would be immediately rendered public’.⁴⁴

His text thus reflected the evolving German intellectual milieu to which he belonged, one in which state and economy were considered interdependent, but no longer consubstantial. The state’s function was increasingly seen as to establish a framework in which economic activity could take place freely and fairly. His belief that preserving the ‘*chose publique*’ necessitated equality of access to this tool of communication also foreshadowed the terms in which the ‘*allgemeine Wohl*’ was to be discussed in the 1850s and 1860s. By then, ensuring the ubiquity and universality of communications technologies for the benefit of free social and economic exchanges would be considered the state’s duty.

List and his contemporaries were hereby expressing a rather broad and diffuse expectation in the potential of telegraphic communication within the framework of existing political and economic thought. Its ultimate goal was not described in any detail, but rested upon assumptions as to the technology’s speed, and the distances which it could cover. Their horizon of expectation lay far beyond their own experience and knowledge of the topic, consisting of possibilities rather than realities, and leaving little sense as to how the gap between the two might be bridged.

⁴⁴ List, *Die Welt*, p. 156.

Even the technical literature on the topic reflected the many different ideas contained within the concept of ‘telegraphy’. The *Technische Deputation* in Prussia and the *Gewerbeverein* in Bavaria, both established in the 1810s, dealt with proposals and patent applications for such inventions, sent in by scientists, technicians and ordinary members of the public, while new polytechnical journals offered a new means of sharing their ideas. *Dinglers Polytechnisches Journal*, begun in 1820, had become and would remain a mainstay of this periodical literature, even after the advent of more specialised organisations and journals from the 1840s.⁴⁵ From its very beginning, therefore, *Dinglers* published a number of articles related to ‘telegraphy’ which give a sense of the principal preoccupations of the time.

Between 1830 and 1838, around eighteen articles made their way into the journal which concerned non-electrical forms of telegraphy or signalling. Initially, the journal’s articles were mainly drawn from foreign publications, but over time an increasing proportion were either original contributions or taken from other German specialist sources. The articles published in the 1830s reveal that there was no consensus on the basic principles of telegraphy. Whilst clearly sharing an understanding of the objective of long-distance communication, the variety of proposals published in *Dinglers*, and the diversity of deficiencies which they identified and sought to resolve is remarkable.

Some efforts were directed towards improving existing optical telegraph mechanisms, particularly their use at night. Various proposals for ‘day- and night-telegraphs’ were put forward, such as that from Le Coat de Kveguen in 1830, or from the Frenchman Ferrier in 1833.⁴⁶ A report translated from the *Liverpool Times* in 1835

⁴⁵ F. Fischer, ‘Dinglers Polytechnisches Journal Bis zum Tode seines Begründers (1820–1855)’, *Archiv Für Geschichte Des Buchwesens*, vol. 15 (2007), pp. 1027–1142.

⁴⁶ Anonymous, ‘Ueber einen Tag- und Nacht-Telegraphen, von Le Coat de Kveguen’, *DPJ*, 35 (1830), pp. 63-4; Anonymous, ‘Ferrier’s Tag- und Nacht-Telegraph’, *DPJ*, 50 (1833), pp. 393-4.

described a ‘night-telegraph’ fuelled by the interaction of oxygen and hydrogen, whilst another, also developed in England, was effectively a form of pneumatic post.⁴⁷ Despite the well-established fundamentals of the Chappe and other optical systems, however, even if one were to adopt a very loose definition of ‘optical telegraphy’, the category would comprise only around four of the eighteen articles evoked. It was the field of telegraphy as a whole, rather than this specific form, which was being explored.

Other articles on new methods of telegraphic communication reported on possible applications of electricity or hydraulics to the task, and a number focused upon the transmission of human speech. The latter included ‘Curtis’ acoustic apparatuses’, a so-called ‘logophor’ which aimed to transmit vocal messages via extended tubes, and a ‘Telephonium’ developed by a certain Mr Sudre. Whilst innovation thus partly touched upon existing ideas, the field remained open as to how long-distance communication might otherwise be developed. Similarly ambitious projects would of course continue to appear over the following decades, but as the first electric telegraph trials were conducted in the late 1830s and early 1840s, the field began to narrow and to revolve around more specific objectives.

Once again, moreover, where potential customers for the use of telegraphy were evoked, business and trade featured prominently. In 1832, for instance, a contributor to *Dinglers Polytechnisches Journal* stressed that it had ‘always communicated all new improvements to the telegraph in our journal, and also often expressed our astonishment that one still had not thought of constructing them in our German states. A commercial telegraph line is currently being erected between Paris and Havre [sic], and we dare to think that our bankers and merchants should imitate this example, if they understand its

⁴⁷ Anonymous, ‘Eisenbahnen in Verbindung mit Telegraphen’, *DPJ*, 56 (1835), p. 74.

benefits'.⁴⁸ Another article estimated the costs of establishing a 'galvanic' telegraph between Edinburgh and London based on the rudimentary knowledge acquired thus far, predicting that newspapers would no doubt make good use of the technology.⁴⁹ The electric telegraph was thus the product of an environment pervaded with diverse ideas as to the purpose of the technology. The state, as we shall see, was but one of the many actors drawn to the project by its ambitious promises.

Managing Expectations

While the Prussian state constructed its optical telegraph line from Berlin to Cologne and the public followed the technology's evolution in newspapers and journals, and while writers opined on the future of long-distance communication, in the early 1830s in Göttingen the mathematician Carl Friedrich Gauß and his collaborator, the physicist Wilhelm Weber, were busy conducting seemingly unrelated experiments to measure the earth's magnetic field. Their efforts were part of a project initiated in 1828 by Alexander von Humboldt, to collect magnetic recordings across a range of countries. By the early 1830s, the undertaking was being coordinated by Gauß and Weber in Göttingen, to whom measurements were sent from a number of the German states' generally well funded observatories – in Berlin, Königsberg, Göttingen and Munich in particular.⁵⁰

In the context of this project, in 1833 the two men began to consider the influence of electricity on the magnets they were employing to make their measurements.

⁴⁸ Anonymous, 'Einiges über die Geschichte der Telegraphen' *DPJ* 43 (1832), pp. 153-4.

⁴⁹ Anonymous, 'Über die Anwendung des Galvanismus zu Telegraphen', *DPJ*, 66 (1837), p. 79.

⁵⁰ C. Jungnickel and R. McCormmach, *Intellectual Mastery of Nature: Theoretical Physics from Ohm to Einstein* (2 vols., Chicago, 1986), i., 63-77.

Experimenting with their ideas, Weber personally extended a wire from the Göttingen observatory, across the town, to the physics cabinet. Having noted that sending electrical impulses across the wire caused the magnets at each end to move in particular ways, the pair then set about transmitting symbols to one another. Eventually, they claimed, they were exchanging ‘whole words and short phrases’.⁵¹ Immediately considering the possible ramifications of this experiment, the two scientists reported their findings in the *Göttingische Gelehrte Anzeigen*, stating: ‘There is no doubt that it would be possible to install a direct telegraphic connection in a similar way between two places separated by a considerable number of miles [*Meilen*]’.⁵²

That Gauß should apply his investigations and instruments to telegraphy was no surprise, however. During the 1820s, when carrying out the comprehensive geodetic survey of the Kingdom of Hanover ordered by George III of England, he had famously developed his sextant-heliotrope. The purpose of the instrument was to concentrate the sun’s rays at one site, and direct them towards a surveyor located a considerable distance away, thus making various points in the landscape visible to the naked eye, even during the day. Noting that the intense flashes of light could be used as signals at a distance, in 1821 he had explained to the astronomer Hans Christian Schumacher that he was sending ‘telegraphic symbols’ with his apparatus.⁵³ Soon, Gauß had been using the heliotrope to send orders to his assistants, and even to announce to a counterpart that

⁵¹ *Göttingische gelehrte Anzeigen* (3 vols., Göttingen, 1834), ii., 1274; One key witness to these experiments was a young Julius Reuter: see L. Guggenbuhl, ‘Reuter, Gauss and Göttingen’, *The Mathematics Teacher*, 51, no. 8 (Dec. 1958), pp. 603-6.

⁵² *Göttingische gelehrte Anzeigen*, ii., 1274.

⁵³ AWG: Gauß Briefwechsel, Gauß to Schumacher, 24 Oct. 1821, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/1123>.

he was departing for their meeting.⁵⁴ Telegraphy had always been on the mathematician's horizon.

Unsurprisingly, then, and contrary to most accounts of the 'stages' of the telegraph's development, Gauß and Weber's 'electromagnetic' telegraph was not a spontaneous experiment, left to others to be developed further.⁵⁵ Not only was it described in the *Göttingische gelehrte Anzeigen* and then reported in other journals, not least *Dinglers*, the two men also continued their experiments for a number of years, and Gauß evoked the topic with his colleagues across Germany.

Alexander von Humboldt is perhaps the first acquaintance to whom he described his idea. On 13th June 1833, he wrote to Humboldt explaining Weber's wire installation and that 'I wish, in particular, to try and use it to make telegraphic symbols'. The apparatus he had in mind would be able to transmit one letter in less than one minute, but he believed that with more apparatuses and circuits, one could, 'by dividing the labour, attain any desired speed'. Unlike his heliotrope which relied upon sunlight, he explicitly admitted, 'electro galvanism' was entirely independent of the weather and time of day. 'I am inclined to believe that [it] could cover enormous distances at one stroke [...] one could correspond directly between Göttingen and Hanover'. Taking the project further, he wrote that he had 'wondered whether in future, once railways are more widespread, the tracks themselves [...] might be used instead of wires'. Costs would be an issue, but he promised to carry out experiments to that end.⁵⁶

⁵⁴ AWG: Gauß Briefwechsel, Gauß to Schumacher, 10 Nov. 1822, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/1143>; AWG: Gauß Briefwechsel, Gauß to Schumacher, 7 Jan. 1825, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/1180>.

⁵⁵ See, for example, K. Beauchamp, *History of Telegraphy* (London, 2001), p. 25.

⁵⁶ AWG: Gauß Briefwechsel, Gauß to Alexander von Humboldt, 13 Jun. 1833, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/616>.

‘Quaint digressions’, was Humboldt’s assessment of the two scientists’ work, in a letter to the astronomer Friedrich Bessel in Königsberg.⁵⁷ As he was perhaps all too keen to point out when writing to Hans Christian Schumacher, ‘[a]lready 20 years ago old Sömmering sent his electric telegraph to Paris; Baron Schilling von Cannstadt is hopeful of introducing his in Russia, and when I was in Spain in 1799, Bétancourt had already worked on such a telegraph [...] from Madrid to Aranjuez’.⁵⁸ As Humboldt implied, the project had a long pedigree among scientists and whilst they shared an expectation in the potential of telegraphy, more impressive results and contributions had to be presented to stimulate interest. On the other hand, his reaction also indicates how keenly such developments were noted, conveyed and discussed across an international network of intellectuals and scientists.

For his part, Gauß maintained his enthusiasm, writing to the Bremen-based astronomer Heinrich Wilhelm Olbers of his discovery: ‘I am convinced that, using strong enough wires, it would be possible to telegraph in this way at one stroke from Göttingen to Hanover or from Hanover to Bremen’.⁵⁹ Olbers himself had heard of this ‘amazing application of Galvanism’, through ‘public rumours, which included some incomprehensible things’.⁶⁰ Clearly, the academic grapevine had been rustling with news of the Göttingen pair’s ideas.

Over the next few years, Gauß and Weber explored the different means by which their telegraph might function. Gauß was clearly deriving much enjoyment from his explorations: ‘might I tell you in confidence’, he wrote to Schumacher, ‘what gives me

⁵⁷ *ibid.*, n. 6, citing K.-R. Biermann, ‘Aus der Vorgeschichte der Aufforderung Alexander von Humboldts von 1836 an den Präsidenten der Royal Society zur Errichtung geomagnetischer Stationen’, *Wissenschaftliche Zeitschrift der Humboldt-Universität*, 12 (1963), pp. 211, 218.

⁵⁸ *ibid.*

⁵⁹ AWG: Gauß Briefwechsel, Gauß to Olbers, 20 Nov. 1833, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/993>.

⁶⁰ AWG: Gauß Briefwechsel, Olbers to Gauß, 3 Dec. 1833, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/4656>.

the most satisfaction in my work, is by far the theoretical conquests in the field of electromagnetism, rather than those in that of pure magnetism'.⁶¹

As the range of articles in *Dinglers* suggested, a number of avenues were being explored in the quest for an efficient electric telegraph, and in 1835 Gauß and Weber began to explore the effects of electricity upon the human body. The current was too weak to be felt by the hands, Gauß explained to Schumacher, but the lips and the tongue were far more sensitive. 'Once again, a new field of most interesting experiments is opening up here', he asserted.⁶² The two men amused themselves with these trials, and Gauß reported to Olbers that 'one can clearly distinguish the sense [*Sinn*] (whether + or -) of a galvanic impulse with one's lips, so that we have already had fun telegraphing in such a way that the despatch [*Depesche*] was tasted [*aufgeschmeckt*].'⁶³ The whole range of human senses was being considered in relation to telegraphy. 'I believe smell is just as sensitive', Schumacher replied to Gauß, 'but I don't see a means of introducing it here'.⁶⁴

On one hand, therefore, Gauß' imagination was given free rein at this stage. Envisioning the future of his telegraphic methods, he believed that 'the despatch that his majesty of all the Russians might like to have played out from St Petersburg could be tasted in Odessa at the very same moment'.⁶⁵ On the other hand, he was also aware of the steps which had to be taken to bring these expectations closer to reality. Tests 'on a greater scale' must first be conducted with his apparatus, he admitted, in order to assess

⁶¹ AWG: Gauß Briefwechsel, Gauß to Schumacher, 6 Aug. 1835, accessed 20 Mar. 2017, at <https://gauss.adw-goe.de/handle/gauss/1294>.

⁶² AWG: Gauß Briefwechsel, Gauß to Schumacher, 13 Sep. 1835, accessed 20 Mar. 2017, at <https://gauss.adw-goe.de/handle/gauss/1296>.

⁶³ AWG: Gauß Briefwechsel, Gauß to Olbers, 11 Nov. 1835, accessed 20 Mar. 2017, at <https://gauss.adw-goe.de/handle/gauss/999>.

⁶⁴ AWG: Gauß Briefwechsel Schumacher to Gauß, 18 Sep. 1835, accessed 20 Mar. 2017, at <https://gauss.adw-goe.de/handle/gauss/5708>.

⁶⁵ AWG: Gauß Briefwechsel, Gauß to Schumacher, 13 Sep. 1835, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/1296>.

how easily it could be handled. ‘In other circumstances than mine’, he felt that the theory of electromagnetism ‘would allow for many applications of importance for the Society, and of glittering practicality in the eyes of the great masses [...] If one could spend thousands of Thaler on the matter, I believe, for example, that electromagnetic telegraphy could be brought to a level of perfection and on a scale which would frighten fantasy itself’.⁶⁶

The contrast between ‘fantasy’ and the costs of reality reflects the scientist’s ability to mediate between expectations and the concrete, even financial means of attaining them. Most accounts, for instance, neglect to mention that in 1835 the academic entered into confidential negotiations with the new Leipzig-Dresden railway company, with a view to combining their project with a telegraph line.⁶⁷ Though it is unclear how this project unravelled, it was certainly among the first, if not the first, such attempt to combine these two means of communication.

That same year, Carl August Steinheil of the Bavarian *Akademie der Wissenschaften* travelled through Göttingen. The young scientist was participating in the collaborative magnetism project from his base in Munich, and visited Gauß in order to collect the instruments necessary to take readings according to the mathematician’s precise methods.⁶⁸ Steinheil had studied astronomy and physics at Göttingen – though during Gauß’ leave of absence – and under Friedrich Wilhelm Bessel at Königsberg. Since 1833, he held the position of *Zweite Conservator der mathematisch-physikalischen Sammlung* at the Bavarian academy, leaving him in charge of the

⁶⁶ AWG: Gauß Briefwechsel, Gauß to Schumacher, 6 Aug. 1835, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/1294>.

⁶⁷ AWG: Gauß Briefwechsel, Gauß to Olbers, 11 Nov. 1835, accessed 17 Dec. 2016, at <https://gauss.adw-goe.de/handle/gauss/999>.

⁶⁸ H. Marggraf, *Carl August Steinheil und sein Wirken auf telegraphischem Gebiete*, (Munich, 1888), p. 14.

region's principal collection of research equipment, and it was in this capacity that he sent his own magnetic readings to Gauß in December 1835.⁶⁹

It is important to note that, at a time when the discipline of physics was struggling to find an institutional foothold, and such future eminences in the field of electricity as Ohm were barely obtaining employment, the network of intellectuals vividly discussing electrical telegraphy could hardly be assigned to one particular field. The mathematician Gauß corresponded with the astronomers Olbers, Bessel and Schumacher on the matter. Steinheil had been trained in both astronomy and physics, the latter discipline most firmly represented by Wilhelm Weber himself, whilst Alexander von Humboldt, of course, was the towering polymath of the era.

It was by means of his contact with Gauß that Steinheil was encouraged to take up their trials in the use of electricity and magnetism to transmit messages. By 1836, having studied the matter of galvanic telegraphy for himself, like Gauß he believed that more extensive trials were needed, and that 'the problem has come as far as science may drive it; what must now happen is of a technical nature, and must be carried out by the technical domain'.⁷⁰ Much like Weber in 1833, he planned to span a wire across Munich, between the physics cabinet in the Bavarian *Akademie* and the observatory in Bogenhausen – a distance of roughly 5 km.⁷¹

Steinheil was evidently aware that his undertaking required external financial and logistical support, for which he would have to stimulate interest. He first turned to the

⁶⁹ J. A. Repsold, 'Carl August Steinheil', *Astronomische Nachrichten* 203, nos. 11–12 (1916), pp. 165–92; cf. also, AWG: Gauß Briefwechsel, Steinheil to Gauß, 3 Dec. 1835, accessed 20 Mar. 2017, at <https://gauss.adw-goe.de/handle/gauss/5122>.

⁷⁰ BHStA, MInn 45175/1, Steinheil to General-Conservatorium, 19 Apr. 1836.

⁷¹ *ibid.*; Carl August Steinheil, *Ueber Telegraphie, insbesondere durch galvanische Kräfte: Eine öffentliche Vorlesung gehalten in der festlichen Sitzung der Königl. Bayerischen Akademie der Wissenschaften am 25. August 1838* (Munich, 1838), p. 22. The total length of the wire, to the observatory and back, was of 30,500 Paris feet (roughly 10 km).

Bavarian *Akademie* for help in securing 800 Gulden, and technical support in carrying out the proposed trial.⁷² As Friedrich Schelling, the Chairman of the *General-Conservatorium*, wrote to the king, ‘in so far as a new scientific [underlined in original] result is not hereby to be expected [...], without which the funds of the *Akademie der Wissenschaften* [...] is not in a position to cover the costs of the proposed trial, any further appraisal lies beyond the competence of the *Conservatorium*’.⁷³ According to its regulations, the academy itself could not therefore provide the funds for Steinheil’s experiment, and the matter was turned over to the *Oberste Baubehörde*.

No doubt aware of these technicalities, Steinheil’s address to the *General-Conservatorium* was framed in terms which evoked the great possibilities of modern science. ‘More than any other science, in recent times, physics has come closer to life itself. The application of its findings has contributed significantly to extending the realm of that which Man can achieve. We witness seas being traversed in the face of violent storms by the power of steam, the greatest distances on land being crossed at a soaring speed [...] These great transformations of the conditions of life have resulted from the materialisation (*Verwirklichung*) of a few fundamentals (*Sätze*) of the physical sciences’. Turning to his experiment more specifically, he emphasised the speed and versatility of the galvanic force: ‘The time necessary to transmit this force is immeasurably small. In a second, it would circle the world a number of times. By day and by night, by all temperatures, under all atmospheric circumstances, over all

⁷² BHStA, MInn 45175/1, Steinheil to General-Conservatorium, 19 Apr. 1836.

⁷³ BHStA, MInn 45175/1, Schelling to Ludwig I, 29 Apr. 1836. It might be noted here that this passage has been misunderstood as demonstrating a certain scepticism towards Steinheil’s inventions, which is clearly not Schelling’s intention – the point is to distinguish between scientific and technical matters, principally for the purposes of financing the project: see H. Pieper, ‘Carl August Steinheil, der vergessene Begründer der wissenschaftlichen Nachrichtentechnik’, *Technikgeschichte* 37, no. 4 (1970), p. 334, whose interpretation has been taken up in R. Seidel, ‘Verkehrsmittel Telegraph: Zur Geschichte der Telegraphie im 19. Jahrhundert bis 1866 unter besonderer Berücksichtigung des Raumes Hannover – Bremen’ (University of Hanover PhD Thesis, 1980), pp. 80-1).

distances – it always remains instantaneous [*momentan*] and equally effective [*gleich wirksam* – underlined in the original]’.⁷⁴

The ultimate aim of his project seemed clear: ‘The application of galvanic currents to telegraphing’. The risks involved were minimal, he assured the authorities, because the trial rested upon ‘an idea which has already been researched theoretically, has been trialled experimentally, promises a certain success, and which only requires implementation on a larger scale in order to come to life in all its importance’.⁷⁵ State support was needed particularly in establishing how wires might in the future be hidden, as such a ‘means of communication’ [*Kommunikationsmittel*] could only remain in the hands of the state. Playing on feelings of patriotism, Steinheil ended by emphasising ‘[t]he importance of the matter, the renown accruing to Bavaria for being the first to carry out an idea which is incontrovertibly one of the greatest of our times, and will very soon be taken up in the entire learned world’.⁷⁶

Steinheil’s rhetorical investment earned its dividends. His address and Schelling’s endorsement were sent on to the *Oberste Baubehörde* with the note that ‘such an experiment, in general, both from a technical perspective and in relation to the general purposes of the state [*Staatszwecke*] is of great interest’.⁷⁷ In approving the requested grant, the government’s chief architect, Leo von Klenze, immediately raised the issue of whether his majesty should maintain telegraphy as a monopoly [*Regal*] or allow private concessions to be made upon particular conditions. He asserted, in any case, that ‘the great benefit which would accrue to the nation through the use of this means of

⁷⁴ BHStA, MInn 45175/1, Steinheil to General-Conservatorium, 19 Apr. 1836.

⁷⁵ *ibid.*

⁷⁶ *ibid.*

⁷⁷ BHStA, MInn 45175/1, Note to Oberste Baubehörde, 4 May 1836.

messaging is clear'.⁷⁸ As we shall see, however, the confidence with which telegraphy was described as being of 'great interest' and clear 'benefit' to the state belied a certain ignorance as to its concrete applications.

Meanwhile, Steinheil's own visions for the future of telegraphy reveal the broad horizon of expectation which he sought to evoke among his interlocutors. Like Gauß, and foreshadowing the many different bodily metaphors and cures which would later be associated with electricity, he saw in the mysterious galvanic force a means of exciting the human senses. His aim, he told the *General-Conservatorium*, was to 'introduce a telegraphic language'. 'In doing so, one is not limited to the realm of feelings [*Gefühlsseins*], like the current telegraphs [presumably a reference to sympathetic needles]. The force can thus be expressed, across a number of leagues, so as to be perceived by anybody. By means of sparks of a particular colour, by causing a platinum wire to glow, or by causing a magnet to rotate out of position, one can act upon the sense of sight; by striking bells, upon that of hearing; by touching the wire, give the senses unmistakeable signals [...]'⁷⁹

Having obtained the required support and carried out his trial, in 1838 Steinheil presented his findings to the *Akademie* in similar terms. He began by stating the aims of science: 'We must listen in on nature's forces and phenomena', he wrote, 'in order to conquer them and to make them carriers of our thoughts, and this is the task of telegraphy in its common sense'. This time, he focused upon human speech as the most advanced means of transmitting thought, implicitly evoking the deficiencies of optical telegraphs: 'We can clearly see that it is a digression when telegraphy strives to imitate an incomplete means of communicating, sign language, as used by disabled people, the

⁷⁸ BHStA, MInn 45175/1, L. v. Klenze to MInn, 20 May 1836.

⁷⁹ BHStA, MInn 45175/1, Steinheil to General-Conservatorium, 19 Apr. 1836.

deaf-mutes'. Instead, he insisted, telegraphy should 'imitate communication [*Mittheilung*] in its most complete form, as speech [*Rede*], whereby the sounds which strike our hearing instinctively catch our attention and lead to comprehension'. Whilst Steinheil's apparatus would also comprise a writing implement, to print incoming signals, his priority was to use electrical impulses to ring two bells, using which a 'spoken' language could be reproduced.⁸⁰ Like Gauß, Steinheil drew inspiration from and manipulated the great expectations which had been placed in telegraphy, aware of the financial and logistical support which their materialisation would require.

Circulating Knowledge, Enrolling Support

As time wore on, however, the circulation of Steinheil's work and his search for assistance began to reveal the different visions and interests lying beneath the horizon, which would have to be negotiated in order to develop the technology. Initially, his presentation to the *Akademie der Wissenschaften* in 1838 was duly published, and the text was widely reproduced. That same year, it was quoted at length in *Dinglers*, whilst a 'Notice sur le télégraphe galvanique de M. Steinheil' was published in the French *Annales de chimie et de physique*, and a parallel article in English made its way into Charles and James Watt's *The Chemist*.⁸¹

Curiously, however, Steinheil published little, if anything more concerning his own telegraph system and apparatus. For instance, the *Kunst- und Gewerbe-Blatt*, the organ of the Bavarian *Polytechnischer Verein* - of which Steinheil was a member - did

⁸⁰ Steinheil, *Ueber Telegraphie*, pp. 4-5.

⁸¹ Anonymous, 'Über Steinheil's elektro-magnetischen Telegraphen mit betreffenden historischen Notizen', *DPJ* 67 (1838), pp. 388-400; 'Notice sur le télégraphe galvanique de M. Steinheil', *Annales de chimie et de physique* 71 (1839), pp. 347-51; 'Notice on the Galvanic Telegraph of M. Steinheil', *The Chemist, or Reporter of Chemical Discoveries and Improvements* 1 (1840), pp. 33-4.

not produce its own article on the subject. The publication merely reproduced an article written by the editor of the Leipzig-based *Polytechnisches Centralblatt*, Julius Hülse.⁸² This silence cannot be attributed to Steinheil's unfamiliarity either with the publication, or with the marketing of inventions. Indeed, in 1834, he had even replaced the former editor of the *Gewerbe-Blatt* on the *Verein's* central administrative committee.⁸³ The association itself, moreover, was deeply involved in assessing proposals submitted to the state for patenting.⁸⁴

It was Wilhelm Weber who encouraged Steinheil to publish his findings as soon as possible, in an effort to pre-empt the actions of his competitors – primarily in England. 'Gauß was wondering', Weber wrote in 1838, 'if you might not be inclined to produce a detailed account of your telegraph'. 'You know that Wheatstone in London is causing quite a stir with such a telegraph', he explained, pointing out that the English professor was preparing an article on the topic. 'It is clear that, especially if this [Wheatstone's publication] is the first essay to appear on the matter and, as will undoubtedly be the case, it is circulated widely and quickly, the whole matter will appear before the world in a false light for a long time'. Weber even suggested that he might publish in his and Gauß' journal dedicated to their magnetism project, the *Resultate aus den Beobachtungen des Magnetischen Vereins*. 'That way, it would soon make its way to England, and especially into the hands of the people there who have the most authority – Herschel, Babbage, Airy, Miller, etc. – and the society in which your account appeared would prevent any misuse in England'.⁸⁵

⁸² J. Hülse, 'Anwendung des Elektromagnetismus auf Telegraphie', *KGB* 16, no. 7 (1838), pp. 412-38.

⁸³ 'Gutachten einer Commission des polytechnischen Vereins', *KGB* 12, no. 4 (1834), p. 1.

⁸⁴ D. E. Thomas, 'Der Polytechnische Verein in Bayern (1816-1933)', *ZBLG*, 64 (2001), pp. 431-460.

⁸⁵ DMM FA005/0614, Weber to Steinheil, 10 Sep. 1838.

What Weber understood, which Steinheil seemed to wilfully ignore, was that publication was increasingly the means of securing one's intellectual property, not simply at home, but on the international knowledge market. Referring once again to the matter in December 1838, Weber insisted that Steinheil at the very least share his work with Wheatstone and Michael Faraday: 'Wheatstone, though he is of a superficial nature, will not fail to act respectfully, and in this matter it is certainly important to circulate in many directions.'⁸⁶

It is unclear why Steinheil was reluctant to follow Weber's advice, but he was also evidently acutely aware of the stakes involved in addressing different audiences. To the *General-Conservatorium* and the Bavarian government, he had emphasised his 'scientific duty' to make his correspondents aware of a development which could be of such importance for mankind.⁸⁷ He had depicted his experiment in the grandest possible terms, as a contribution to the onward march of 'physics' and to the reproduction of human speech.

However, in his notes for an article which appears to have been published in edited form in Schumacher's *Jahrbuch für Astronomie* for 1839, Steinheil also seemed to regret that readers were interested in 'specific ideas' rather than their practical development. 'As long as [these ideas] exist only in the imagination, the wish cannot be expressed often enough that it would be possible to realise them, and men dream of the advantages which might be obtained from the diffusion of that which is being prepared. Once this has happened, one takes the matter for granted and the interest disappears'.⁸⁸ These comments could well describe the contemporary discourse on telegraphy, and the

⁸⁶ DMM FA005/0614, Weber to Steinheil, 18 Nov. 1838.

⁸⁷ BHStA, MInn 45175/1, Steinheil to General-Conservatorium, 19 Apr. 1836.

⁸⁸ DMM FA005/0399, Notes, 'Noch eine Mittheilung über den viel besprochenen Telegraphen', undated (probably 1838/9).

very terms in which he himself had ‘sold’ his project, and which the *Akademie* and the government had bought into. The second part of his statement suggests a certain frustration, perhaps at the lack of state support now that his experiments had been carried out.

There was a type of ‘art’ (*Kunst*), Steinheil believed, which sought to maintain an interest in such ideas by preserving the ‘veil which contains temptation’, in order to ‘maintain fantasy in tension’. This art, however, stood in ‘stark contrast with the tendency of the researcher, who sees in wingèd fantasy rather an enemy’. Here was a clear indication, therefore, that there were limits to Steinheil’s willingness to fuel unrealistic expectations. A researcher, he believed, prefers to ‘present the naked truth, whether or not it is as pleasing as the earlier fantasy [...] the researcher thus proceeds to disappoint’.⁸⁹ Echoing Gauß’ comments on the ‘fantasy’ involved in his project, this statement hints at the direction of developments in telegraphy at the time. Lofty visions as to the nature and purpose of the technology provided a leitmotif throughout its development. Expectations had to be raised to stimulate interest and involvement, but these would necessarily have to be tempered as experimentation and trials were undertaken.

With regards to telegraphy, ‘whose feasibility is now proven’, Steinheil wrote, it was time ‘to approach the sober question, [...] whether the cost which it demands can be outweighed by the advantages obtained’. This practical reasoning, in Steinheil’s mind, no longer fell within the purview of the scientist.⁹⁰ Having successfully pitched his contribution to science and communication, Steinheil was practically calling for others to engage in the more mundane aspects of the work ahead, and recognising a

⁸⁹ DMM FA005/0399, Notes, ‘Noch eine Mittheilung’.

⁹⁰ *ibid.*

boundary between his competency and others'. Immediate expectations had to be brought closer to reality if the telegraphic project was to be realised. The state collaborators whom Steinheil sought out struggled to make this shift, however.

Confronting Reality

In March 1838, whilst preparing to present his findings to the *Akademie* in Munich, Steinheil had also proposed to pursue his trials, this time along the very first Bavarian – and German - railway line between Nuremberg and Fürth. In particular, like Gauß before him, he had hoped to determine whether the metal tracks themselves might be used to conduct electric current and serve as a telegraphic circuit.⁹¹ As in 1836, when Leo von Klenze had asserted the 'great benefit' which Bavaria would derive from telegraphy, the Minister of the Interior Karl von Abel supported this new trial. He emphasised to King Ludwig I 'the important role which it is probable that this new means of communication will play in the near future'.⁹² As the stakes were raised, however, such broad statements became insufficient.

Back in 1836, Leo von Klenze had heard rumours that the Saxon government had allowed a telegraph line to be erected alongside the new railway between Dresden and Leipzig – no doubt related to Gauß' negotiations with the company. Among Klenze's concrete concerns had been the response to prepare should other railway companies make similar requests in Bavaria, and to establish the state's position vis-à-vis these means of communication.⁹³ By 1838, as he approved the request for an extra 500 Gulden to complete Steinheil's trials, Ludwig I also expressly requested that the

⁹¹ BHStA, MInn 45175/1, Steinheil to Ludwig I, 16 Mar. 1838.

⁹² BHStA, MInn 45175/1, Abel to Ludwig I, 10 May 1838.

⁹³ BHStA, MInn 45175/1, L. v. Klenze to Ludwig I, 20 May 1836.

question be addressed as to ‘how [the telegraph] is to be used to the advantage of the state’.⁹⁴ If the state was to engage in the development of this technology, its concrete interest in the matter was to be identified.

The response, however, was uncertain. Two years later, in 1840, Abel stated that it was not yet possible to evaluate whether the advantages of the telegraph for the purposes of the state and the public administration would outweigh its costs, as all results had not yet been collected. Crucially, he also believed that the telegraph ‘could interfere all too deeply with the administrative organism and the correspondence methods of the public authorities’. Furthermore, any income which might be generated by the public use of a telegraph service would have to cover the losses incurred by the state postal service.⁹⁵ Having taken on board Steinheil’s demand for external involvement in the technical facets of the telegraph’s development, the state considered that the practical and logistical costs outweighed its benefits.

Abel did believe that Steinheil’s trials should be pursued along the Nuremberg-Fürth railway line, but he admitted the unpredictability of its future utility. In Bavaria, therefore, the general public was clearly understood as the most likely primary user of the service once it was established, and thus as a source of income for the state. However, ‘as with every invention which can be of general use’, Abel reported to the king, it was impossible to tell ‘if there is a need for such a product before its diffusion’ [underlined in the original]. Furthermore, he believed, ‘nobody can predict to what

⁹⁴ BHStA, MInn 45175/1, Abel to Ludwig I, 10 May 1838, approval from King Ludwig I on 12 May 1838.

⁹⁵ BHStA, MInn 45175/1, Abel to Ludwig I, 13 Apr. 1840.

extent it will become viable and stimulate a usage which might little by little become a general need'.⁹⁶

Informing Steinheil that further trials would be conducted along the new Munich-Augsburg railway instead, Abel explicitly stated that the purpose of these essays was 'to discover whether the public will use this new means of communication to an extent which will make its construction significantly profitable on a long-term basis [...]'.⁹⁷ To the king, on the other hand, Abel emphasised that 'the object is nonetheless so important and designed in such a way' as to call for support in future experimentation.⁹⁸

This continuous oscillation between rather vacuous statements concerning the importance, utility and 'benefit' of the technology on the one hand, and the impossibility of assessing these qualities on the other, reflects the authorities' repeatedly changing field of vision as they sought to identify their immediate interests whilst keeping the ultimate, distant objective in their sights. It testifies to the enduring power of the original expectations, just as possibilities were confronted with realities.

Bavaria was not peculiar in this regard. In Prussia, for instance, both news of Steinheil's experiments and the same rumours of a trial along the Saxon railway had stimulated interest in electrical telegraphy, but opinions remained divided.⁹⁹ To be sure, since the establishment of Prussia's optical telegraph line in 1832, there existed a department dedicated to the technology, led by Major O'Etzel and under the authority of the Ministry of War. Despite historians' insistence on the military domination of telegraphy in Prussia, however, its introduction and development had very much

⁹⁶ BHStA, MInn 45175/1, Abel to Ludwig I, 13 Apr. 1840.

⁹⁷ DMM FA005/0582, Abel to Steinheil, 13 Apr. 1840.

⁹⁸ BHStA, MInn 45175/1, Abel to Ludwig I, 13 Apr. 1840.

⁹⁹ E. Feyerabend, *Der Telegraph von Gauss und Weber im Werden der elektrischen Telegraphie* (Berlin, 1933), pp. 182, 187.

depended upon O'Etzel's personal enthusiasm.¹⁰⁰ The military arm of the Prussian state, in fact, had been reluctant to abandon its ideal of quasi-medieval warfare, and was only slowly becoming more receptive to the utility of technology in general.¹⁰¹

In any case, the process stalled when the Minister of the Interior reported the conclusions of the Minister of War regarding the use of telegraphy along railways as a means of supporting policing practices: '[I]t does not seem to him to be the time to establish general measures for the aforementioned purposes, because the invention has not yet reached a stage at which it may be possible to make a definitive decision relating to its utility and suitability for these purposes'.¹⁰² While horizons were narrowing to meet the realistic expectations of everyday practice, uncertainty prevented state authorities from making the leap of faith required to invest in the technology.

Moreover, where support was forthcoming, interests did not always align. As will be explored in chapter 2, the main initial source of investment in telegraphy would indeed come from another newly emerging sector – railway construction. In Britain, for instance, Charles Wheatstone and William Cooke installed their electrical telegraph system along a segment of the Great Western Railway in 1838. The apparatus was used for the purposes of signalling, and similar applications of the technology were to help regulate railway traffic throughout German states and in France from the early- to mid-1840s. The more immediate utility of the technology in this case required a smaller leap of faith.

In Bavaria, the railway-based trials proposed by Steinheil in 1838, which had been relocated from Nuremberg to Munich, had called for collaboration with the München-

¹⁰⁰ Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland*, p. 146.

¹⁰¹ E. D. Brose, *The Politics of Technological Change in Prussia: Out of the Shadow of Antiquity, 1809-1848* (Princeton, 1993), pp. 164-89; D. Showalter, *Railroads and Rifles: Soldiers, Technology and the Unification of Germany*, (Hamden, Conn., 1975), pp. 143-60.

¹⁰² Feyerabend, *Der Telegraph*, p. 191.

Augsburger Eisenbahn-Gesellschaft. By the end of October 1840, the company informed Steinheil that they were prepared to begin the trials at his convenience. Having then installed his telegraph system along the railway track between the towns of Maisach and Olching, Steinheil seems to have left the installation to the supervision of the railway company's own staff, but technical issues arose when the line was left unattended.¹⁰³ Writing angrily to the board of directors, Steinheil asked: 'why should it be that the galvanic telegraph is only advantageous where there are railways? Purely and solely because of the supervision of the wires and its reparation [...] by the personnel which is already assigned to the supervision of the tracks [...] This supervision and preservation of the line is thus the only thing which materially links railways and galvanic telegraphs'.¹⁰⁴

Indeed, Steinheil appears not to have understood the logistical utility of the telegraph to the railway company itself. Around the same time, Steinheil made a note of the questions which he would have to put to the Railway Committee, among which he asked 'what use would the committee make of such a telegraph for its own purposes?'.¹⁰⁵ Yet the negotiations between the state and the company, and the earlier example of the Dresden-Leipzig line had suggested that railways had their own reasons to employ the telegraph. Having united the logistical and scientific know-how necessary to developing the technology around a common objective, the partnership thus broke down as individual interests came to light.

Steinheil's reluctance to accommodate different interests was also reflected in his disagreement with the state over the *Privilegium* for which he had applied in August 1838. Although south-German states were particularly liberal in their attitude to

¹⁰³ DMM FA005/0582, Directorium der M-A Eisenbahn-Gesellschaft to Steinheil, 22 Feb. 1841.

¹⁰⁴ DMM FA005/0582, Steinheil to Directorium der M-A Eisenbahn-Gesellschaft, 8 Mar. 1841.

¹⁰⁵ DMM FA005/0582, Notes, undated.

patenting, Steinheil had sought excessive protection for his telegraph system.¹⁰⁶ As the Minister of the Interior Abel explained to him, his request had been denied because he had asked for a *Privilegium* encompassing ‘exclusive execution (*alleinige Ausführung*)’ of the project. The minister informed him that he was welcome to re-apply for a patent, as long as he did not claim exclusive rights of usage.¹⁰⁷ Although the state was still unsure of its own motivations for constructing a telegraph line, the patenting process had drawn its attention to more immediate concerns and to the defence of its interests.

The Case of Bremen

Often overlooked, the north-western coast of Germany offers an informative contrast to these developments. In 1838, the merchant and vinegar manufacturer Johann Ludwig Schmidt obtained a concession from the Hamburg *Senat* to construct an optical telegraph line linking the town to its port in Cuxhaven at the mouth of the river Elbe. The installation served principally to facilitate communication between merchants and ship-owners based in Hamburg, and the vessels entering or leaving the waterway to and from the North Sea.¹⁰⁸ In effect, Schmidt’s project was to fulfil the wish expressed in 1799 to the *Gesellschaft zur Beförderung der Künste und nützlichen Gewerbe*, and replicated similar installations in other coastal towns such as that between Holyhead and Liverpool in Britain.¹⁰⁹

¹⁰⁶ M. Seckelmann, *Industrialisierung, Internationalisierung und Patentrecht im Deutschen Reich, 1871-1914* (Frankfurt am Main, 2006), pp. 100-2

¹⁰⁷ DMM FA005/0582, Abel to Steinheil, 3 May 1839.

¹⁰⁸ Seidel, *Verkehrsmittel Telegraph*, pp. 197-200.

¹⁰⁹ See p. 45; G. J. Holzmann, ‘Die optische Telegraphie in England und anderen Ländern’, in K. Beyrer and B.-S. Mathis (eds.), *So weit das Auge reicht: Die Geschichte der optischen Telegraphie* (Karlsruhe, 1995), pp. 116-30.

Drawing on the success of his initiative, in November 1838 Schmidt turned his attention westwards. In Bremen he found a situation analogous to that in Hamburg, as the city-state was heavily dependent upon its ties to the harbour in Bremerhaven, at the mouth of the Weser. Schmidt therefore proposed to connect the two sites with an optical telegraph line, and as the project was beneficial to merchants and ship-owners, his idea was pitched as a private enterprise. The aim was to establish a public limited company, whose shareholders would also receive dividends issuing from profitable use of the service.

Schmidt's appeal in Bremen was based upon experience and knowledge of the concrete difficulties which telegraphy might be expected to alleviate. 'The results which have issued from that [Hamburg-Cuxhaven] line enable us to conclude that, just as the enterprise there is profitable to the shareholders, so might adequate dividends be expected for the signatories here too, given the known communications relations between Bremen and Bremerhaven'. His more ambitious project eventually to connect the Hamburg-Cuxhaven and Bremen-Bremerhaven lines was similarly based upon the 'known' potential benefits of tying these 'sister towns'.¹¹⁰

Indeed, the telegraph appeared to solve a very real problem which Bremen had faced since the early decades of the nineteenth century. Over hundreds of years, an accumulation of sand had rendered the Weser inaccessible to ships at the level of Bremen itself, such that this 'port' town's very existence was under threat by the 1820s. A partial solution to this issue had been found in 1827, when Bremen's renowned *Bürgermeister* Johann Smidt had negotiated the appropriation of a portion of the Duchy of Oldenburg's coastal territory. There, around 60 km further downstream on the Weser,

¹¹⁰ StAB 2-R.15.b.2, J. L. Schmidt, 'Einladung zur Unterzeichnung von Actien für den bremischen Telegraphen-Verein', 8 Nov. 1838.

Bremen had established its new port: Bremerhaven.¹¹¹ The optical telegraph proposed by Schmidt now offered ship-owners and merchants the possibility of remaining in Bremen and communicating with their ships in Bremerhaven via semaphore, enhancing their ability to coordinate the loading and unloading of their imports and exports.

The Bremen *Senat*'s approval of Schmidt's concession request recognised the benefits which his project might produce. The commission for Bremerhaven began by asserting the 'general considerations which render the multiplication and improvement of communications desirable for a trading post'. It emphasised, however, the increased utility of a Bremen-Bremerhaven connection given the 'local conditions', characterised by 'the significant distance of the central point of our trading life from the harbour and moorings of our ships'.¹¹² In contrast with the consideration of proposals in Bavaria and Prussia, the language used by both Schmidt and the *Senat* reflected the concrete potential for the telegraph to improve existing conditions.

Indeed, in Bremen the Weser was the lifeline of both the elite merchant community and the city-state as a whole, which depended upon the success of trade. Notwithstanding a long history of disagreements and constitutional settlements, therefore, their respective representatives, the *Handelskammer* and the *Senat*, often cooperated, recognising that politics and trade went hand in hand. The Cameralist heritage was lacking which elsewhere in Germany had created tensions between a bureaucracy pursuing the higher objective of a well-ordered state and the materialist pursuits of an emerging *Wirtschaftsbürgertum*. In sharp contrast to the attitude of Prussia to its optical telegraph line, for instance, the commission for Bremerhaven considered it an advantage that Schmidt's project was to be carried out by private

¹¹¹ H. Schwarzwälder, *Geschichte der Freien Hansestadt Bremen* (4 vols., Bremen, 1975-85), ii., 121-34.

¹¹² StAB 2-R.15.b.2, 'Bericht ad Supplikat Joh. Ludw. Schmidt pro Anlage einer Telegraphenlinie', 16 Jan. 1839.

industry, and therefore at ‘private risk’.¹¹³ This economic liberalism was tied to a particular brand of social conservatism, based on the notion that the city-state was an organic whole – a blend which Lars Maischak has termed ‘cosmopolitan conservatism’.¹¹⁴

Like the railway administrations and companies, merchants and ship-owners could easily integrate the telegraph into their existing operations. In Bremen too, the commission had suggested extending the use of telegraphy beyond the merchant community itself. It was proposed that the service be opened to all, in exchange for a fee, and that the *Senat* might itself make use of the telegraph when communicating with the relevant governmental bodies.¹¹⁵ But the organic – rather than holistic - conception of state and economy ensured that all shared similar interests: the growth of the latter supported the former. Indeed, it was only later that other German states would resort to such concepts to make sense of communication within their own contexts.

However, despite the proven success of the telegraph between Hamburg and Cuxhaven, as well as the support of the *Senat* in principle, Johann Ludwig Schmidt’s project was not to come to fruition for a number of years, by which stage the electric telegraph had made its appearance on the technological and commercial scene. Part of the issue lay in the difficulty Schmidt experienced in obtaining the necessary concession from the Hanoverian government, on whose territory the connection between Bremen and Bremerhaven was to run.¹¹⁶ In addition, however, the entrepreneur failed to attract the investment he had hoped for, and was never able to establish his projected

¹¹³ StAB 2-R.15.b.2, ‘Bericht ad Supplikant Joh. Ludw. Schmidt pro Anlage einer Telegraphenlinie’, 16 Jan. 1839.

¹¹⁴ L. Maischak, *German Merchants in the Atlantic* (Cambridge, 2013), pp. 82-107.

¹¹⁵ StAB 2-R.15.b.2, ‘Bericht ad Supplikant’, 16 Jan. 1839.

¹¹⁶ StAB 2-R.15.b.2, J. L. Schmidt to Senat, 12 Dec. 1843.

‘*Telegraphen-Verein*’.¹¹⁷ Indeed, even in Hamburg, the demonstrated utility of the telegraphic connection to Cuxhaven belied the little support which Schmidt had received from individual investors - even after establishing an *Aktiengesellschaft* there, the entrepreneur was forced to buy the majority of the shares.¹¹⁸

In a reverse development of that elsewhere in Germany, there existed a fertile ground of common interests in these city-states, but the lack of long-term ambitions, a narrow horizon of expectation had failed to provide the required incentive. The issue was compounded by the mechanical, observable and somewhat cumbersome nature of optical telegraph installations which did not lend themselves as easily to the visions of multi-sensorial, telegraphic speech evoked by Steinheil and Gauß. Once such promises began to circulate, however, this fertile ground would bear its fruit, and Bremen was to be one of the first states in Germany to introduce the technology.

Conclusion

By the late 1830s, expectation in telegraphy’s potential had begun to gather together the diverse intellectual, scientific, and entrepreneurial forces which were to drive its development. In doing so, however, it had forced the actors concerned to narrow their horizons and consider their more immediate interests in the project. Drawing upon a common fund of ideas and information regarding the technology and communication in general, writers, scientists and bureaucrats had initially defined their ultimate goal in similar terms. Now that various trials, improvements and applications of the technology were under consideration, however, an expanding network of actors

¹¹⁷ StAB 2-R.15.b.1, ‘Extract aus dem Senatsprotocolle’, 29 Oct. 1845; cf. also Seidel, *Verkehrsmittel Telegraph*, p. 204.

¹¹⁸ Seidel, ‘Verkehrsmittel Telegraph’, p. 198.

came to depend upon one another for financial, technical and logistical help, and were required to negotiate their interests.

For the time being, the horizon of expectation associated with telegraphy shifted out of focus. Across Germany and Europe, some scientists turned to the state for support in their trials, others to private enterprise; railway companies began to consult with ministers and academics for help in developing new signalling technologies; budding entrepreneurs such as Werner Siemens in Berlin discovered the networks of information exchange which bureaucrats themselves were using to inform their decisions regarding the technology. Like delegates arriving at a conference of allied powers, these actors had initially gathered around a common purpose, but as immediate circumstances required them to prepare for extended deliberations, new hopes and frustrations began to emerge.

Chapter Two: Realities

When it emerged, in October 1840, that the experimental telegraph line established by Carl Steinheil along the Munich-Augsburg railway had been left without supervision, and had been interrupted as a result, the academic instinctively turned to the state authorities for assistance. Having already complained to the railway company's board of directors, Steinheil wrote to the *Präsidium* of the regional government, asking that the company be mandated to conduct the trial according to his precise instructions.¹ This attitude infuriated the board of directors: Why, they asked, had he turned to the government instead of addressing them directly?² Disregarding the potential utility of the telegraph to the company itself as a means of railway signalling, Steinheil asserted that the 'supervision and preservation of the line is [...] the only thing which materially links railways and galvanic telegraphs'.³

By 1842, oversight of the trials had been transferred to the Bavarian state's *Eisenbahnbau-Kommission*, removing the private company from the equation. When the king asked a further special commission to assess whether the results of Steinheil's experiments 'are such, that the steps might be taken to construct a reliably usable telegraph line', however, it was forced to report that the scientist was refusing to cooperate.⁴ Tired of the incessant questions and trials ordered by the state, Steinheil wrote: 'The commission can now clearly see that these experiments – which I did not conduct upon the request of the government – are my private property'. 'If the government wishes to make use of my invention', he continued, 'then I would humbly

¹ BHStA, MInn 45175/1, Steinheil to Regierung Oberbayern, 24 Oct. 1840.

² DMM, FA 005/0582, Directorium to Steinheil, 28 Oct. 1840.

³ DMM, FA 005/0582, Steinheil to Directorium, 8 Mar. 1841.

⁴ BHStA, MInn 45175/1, Präsidium Regierung Oberbayern to MInn, 7 Aug. 1842.

ask that the Royal Ministry address itself to me as a private person, and take into account further conditions on my part [...]’⁵

Such were the conflicts and frustrations which accompanied the necessary collaboration of scientists, technicians, railway companies and state officials in developing the telegraph during the 1840s. The expectations raised by the prospect of long-distance communication were now confronted with reality as ideas were compared, trials carried out and decisions made regarding the future uses and implementation of the technology. The information required to resolve the logistical, financial and technical questions involved circulated widely between the actors concerned. Whilst they depended upon each other’s material and intellectual resources, however, the process also encouraged them to delimitate their respective spheres of interest, authority and expertise. For a while, a productive tension reigned.

Railway companies were the first to implement and utilise the electric telegraph. During the 1830s, as we have seen, Carl Gauß and Carl Steinheil had both considered whether railway tracks might not serve as an electrical circuit. The scientists’ hopes were dashed, but railway companies realised the utility of telegraph wires in transmitting short signals along their lines, enabling them to manage the passage of trains and coordinate their services. Britain set the example in this regard, when William Cooke and Charles Wheatstone first trialled their telegraph along the Great Western Railway in 1838.⁶ No doubt aware of this experiment, the München-Augsburger Eisenbahn-Gesellschaft had then agreed to Steinheil’s trials along their line in 1840, and others soon followed suit.

⁵ DMM, FA 005/0582, Response to the commission established on 18 July, 28 July 1842.

⁶ K. Beauchamp, *A History of Telegraphy* (London, 2001), pp. 31-2.

The railway companies' experiments with the new technology were followed closely by state authorities. Still unsure of their own use for the technology, governments nonetheless pursued their own inquiries into its development, increasingly aware that their control over a potentially revolutionary means of long-distance communication was at stake. In Bavaria, Carl Steinheil's telegraph was still under consideration by the Ministry of the Interior, though it now fell within the technical jurisdiction of the *Eisenbahnbau-Kommission zu Nürnberg*, established in 1841 to pave the way for state ownership of the railways.⁷ In Prussia, a *Telegraphen-Kommission* was finally established in 1844 to investigate the technology, under the authority of Major O'Etzel, director of the state's optical telegraph line, and the Ministry of War.⁸ A similar pattern emerged in Austria, where a commission was established in 1845.⁹

Telegraphy was thus inevitably caught up in the negotiations between the state and the private sector which characterised the German railway industry during the 1840s.¹⁰ In technical, logistical and financial terms, however, the aims of the state and of the railway industry were also somewhat complementary. Telegraph lines certainly did not require investment on the same scale as that which fuelled the railway industry and which had tied the development of the sector to the question of Prussia's constitution.¹¹ Nevertheless, governments expected to use the channels created by railways to establish their wires, in order to avoid the need for further expropriations. In addition, the results of trials undertaken by private companies substantially informed decisions made by state commissions investigating the same technology.

⁷ D. Götschmann, *Wirtschaftsgeschichte Bayerns: 19. und 20. Jahrhundert* (Regensburg, 2010), p. 59.

⁸ H. A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland und die rheinische Industrie : von den Anfängen bis zum Ausbruch des Ersten Weltkrieges* (Wiesbaden, 1983), p. 150.

⁹ G. Lobentanz, 'Zur Geschichte der Telegraphie in Österreich: Von den Anfängen bis ca. 1850' (University of Vienna PhD Thesis, 1967), pp. 21-7.

¹⁰ L. Gall and M. Pohl (eds.), *Die Eisenbahn in Deutschland: Von den Anfängen bis zur Gegenwart* (Munich, 1999), pp. 13-27.

¹¹ *ibid.*, pp. 21-4.

In many respects, therefore, the development of telegraphy relied upon much the same cooperation of state officials, businessmen and industry experts which, as James Brophy has demonstrated, was necessary to the construction of railways in Prussia during the period.¹² Even outside Prussia, where state ownership of the railways was greater, it was very much the railway sector as a whole which gave immediate use and credibility to the technology. In both cases, however, a detailed consideration of the many forces behind the ‘modernisation’ of Germany suggests that the distinction between the roles of state and civil society in the process is overly simplistic.

Indeed, such distinctions are further blurred when one considers the remarkable overlap in the sources from which the actors in question drew their information on the technical details of the telegraph. From ministers to chief engineers and individual entrepreneurs, the answers to their questions were sought in a common, growing fund of ‘useful knowledge’ and expertise, which circulated through a variety of social channels, as well as newspapers and journals. Moreover, the pool of actors directly or indirectly involved in discussing the technology expanded as reports of new experiments were published, read, and adapted.

Taking into account the numerous exchanges between these agents suggests the limitations of traditional historiographical inquiries into the respective roles of the state and entrepreneurs in German industrialisation.¹³ For all the influence of government departments, educational establishments, of individuals’ social background and professional training in stimulating economic development, it is often the connections between these different sources which are most striking. The ‘useful knowledge’ which lay at the heart of the telegraph’s development was distributed and exchanged across a

¹² J. M. Brophy, *Capitalism, Politics, and Railroads in Prussia, 1830-1870* (Columbus, 1998), esp. pp. 22-52.

¹³ See Introduction, p. 21.

broad landscape of innovation, in which Prussia was only one region.¹⁴ As this knowledge circulated, its numerous consumers and producers located at different sites within the landscape helped to further shape the concept and material reality of telegraphy in different ways.

At the same time, however, a variety of ambitions were brought to bear upon the technology, each party pulling it in different directions, defending their interests, expertise or authority over its development during the negotiations with their collaborators. In the process, for instance, the state was forced to consider its attitude to communication, evoking the debates to which Robert von Mohl and Friedrich List were contributing; Carl Steinheil affirmed his right to his intellectual property; and railway companies sought favourable terms from the state in allowing them to pursue this necessary technological innovation. Meanwhile, reports of developments abroad stimulated competition between states, and even within them, as a market opened between these different interested parties, providing new opportunities for investment and enterprise.

Tension was the inevitable corollary to this necessary cooperation of diverse social and institutional actors in bringing the technology to life. As state representatives, scientists, entrepreneurs and technicians interacted to gain the resources they needed from one another, they also discovered their differences. Until 1847, the fruits of their collective labour outweighed the difficulties which they faced, but the friction between them eventually threatened to grind the process to a halt.

¹⁴ On the regional dimensions of German industrialisation, see G. Herrigel, *Industrial Constructions: The Sources of German Industrial Power* (Cambridge, 1996); On individual regions, see, for example I. Burkhardt, *Das Verhältnis von Wirtschaft und Verwaltung in Bayern während der Anfänge der Industrialisierung (1834-1868)* (Berlin, 2001); on Saxony, see H. Kiesewetter, *Die Industrialisierung Sachsens: Ein regional-vergleichendes Erklärungsmodell* (Stuttgart, 2007).

Defining Spheres of Interest, Expertise and Authority

In March 1838, Steinheil's proposal to trial the use of railway tracks as telegraphic conductors on the Nuremberg-Fürth railway line had been both pragmatic and scientific, but its implications had been wider-reaching. Given the state's demonstrated interest in the technology, and its support for Steinheil's work up until this point, the proposal required the government to engage with the relevant railway company, whose statutes had been granted by the king. In Steinheil's view, the possibility of employing tracks instead of wires to transmit electric signals could potentially simplify the construction of telegraph networks, but for the state it raised the prospect of negotiations with the railway companies involved.

As Steinheil began these trials in June of the same year, along the selected section of the *Ludwigsbahn*, the Minister of the Interior wrote to the *Regierungspräsidien* of Oberbayern, Mittelfranken and the Pfalz. These were the regions which were to host the construction of Bavaria's first railway branches, and the local governments were therefore asked to approach the companies concerned. In particular, the Minister wished to know the conditions under which they would allow for 'the government – and it alone – to be entitled to use the railway in question [...] for the conduction of electro-galvanic telegraphy, free of charge, and for the costs arising in constructing the railway for this purpose to be carried by their shareholders'.¹⁵ Anticipating elevated costs, and in the hope of establishing its authority over any future network, the state thus put forward ambitious terms of negotiation.

Unsurprisingly, the response was not especially accommodating. To begin with, the managing committee for the railway from Nuremberg to the northern border

¹⁵ BHStA, MInn 45175/1, Abel to Präsidien of Oberbayern, Mittelfranken and the Pfalz, 13 June 1838.

explained that such a decision could not be made without the assent of a general assembly. In addition, it complained that given the conditions already imposed on ‘such enterprises’, it was ‘alarming to burden these further with the construction costs for an object of benefit to the state; for in this way [...] the already reduced willingness to undertake such enterprises would continue to sink ever deeper, and eventually render their fulfilment unadvisable’.¹⁶

Nor were these businessmen the only obstacle to the project. The Nuremberg-Fürth segment had been chosen as the site for Steinheil’s experiment partly in order for the government to evaluate potential public uptake of the service. This particular line was considered apposite for such an assessment, because of the ‘industrious’ nature of the two towns concerned, which would provide a good sense of the future market for the telegraph.¹⁷ In 1840, however, the postal officials in Nuremberg, as well as the municipal councillors and representatives of the *Handelsstand* in Fürth, refused to allow the trial to go ahead on the grounds that no new means of communication besides the railway was necessary.¹⁸ The cooperation which was necessary to the technology’s development had begun to reveal the rifts between central and local government, private sector interests, and local businessmen.

It was as a result of the two northern towns’ objections that Steinheil’s trials had been relocated in 1840 to the new railway under construction between Munich and Augsburg. From Interior Minister Karl von Abel’s perspective, the shift was all the more advisable given that these ‘two principal towns of the Kingdom promise more significant results and a more decisive and profitable success of the trial to be

¹⁶ BHStA, MInn 45175/1, Provisorisch dirigierender Ausschuß to Regierungspräsident Mittelfranken, 19 June 1838.

¹⁷ BHStA, MInn 45175/1, ‘Registratur abgehalten den 19 Nov. 1838’, 19 Nov. 1838.

¹⁸ BHStA, MInn 45175/1, Abel to Ludwig I, 13 Apr. 1840.

undertaken'.¹⁹ This time, moreover, the München-Augsburger Eisenbahn-Gesellschaft's enthusiastic commitment to the project exceeded the state's hopes.

By now, it had been recognised that even specially modified tracks could not serve as conductors, and that telegraphy would have to rely upon wires, but these required a much smaller investment. Not only would the company allow the trial to go ahead, it would even pay for the whole affair, so long as it was granted use of the telegraph line when it was not needed by the state.²⁰ It was this request which appeared to puzzle Carl Steinheil: 'what use would the committee make of such a telegraph for its own purposes?', he had jotted down in his notes.²¹ Soon, indeed, Steinheil was plunged into the conflict with the Gesellschaft evoked at the beginning of this chapter.

Even before the trials were carried out, Abel recognised that, although the state administration itself would make little use of the technology, its potential utility to the public raised the question of the government's attitude to communications networks. The telegraph was considered to be of 'analogous nature to the royal postal institution', and should therefore be placed within the latter's jurisdiction. In legal terms, to do so would empower the king to fund telegraphy with the state's revenue, particularly profits from the postal service. The king would thereby be acting constitutionally, as the undertaking was 'aimed at the common good (*allgemeine Wohl*)', as a means 'of the greatest importance for the acceleration and facilitation of exchanges over great distances'. Steinheil's trial, meanwhile, would ensure that this initiative was not introduced 'and money spent, without first having experience of its utility and practicability'.²² The government had thereby sought to establish its legal authority

¹⁹ BHStA, MInn 45175/1, Abel to Ludwig I, 13 Apr. 1840.

²⁰ BHStA, MInn 45175/1, Steinheil to Ludwig I, 23 July 1840.

²¹ DMM, FA005/0582, Notes, undated.

²² BHStA, MInn 45175/1, Abel to Ludwig I, 25 Apr. 1840.

over the future institution, and to defend as far as possible its financial interest in the matter.

With the creation of the *Königliche Eisenbahnbau-Kommission zu Nürnberg* in 1841, the state prepared the ground for its ownership of the railways. Along with telegraphy, it seemed, these technologies would join the postal service in a process of institutional integration which complemented King Ludwig I's policy of cultural assimilation, uniting the disparate regions attached to the kingdom in 1806 around a common sense of Bavarian identity.²³ But the establishment of the commission had also made its chief engineer, Friedrich August Pauli, responsible for overseeing telegraph trials and improvements. To its financial and logistical competence, the government thereby added its technical expertise too.

For his part, Abel now began to question the viability of telegraph networks as a whole, given the technology's current state of development. 'The construction of telegraphs', he explained, 'is only of benefit when they extend over a significant distance, and leave other means of communications far behind in their speed of transmission'. The railway between Munich and Augsburg would already allow for messages to be sent and received in around two hours, and faster if necessary, and in his view 'the exchanges between the [two towns] are not of such significance that a faster means of communication should be necessary'. No advantage would be gained, nor the invested capital recuperated before the line in question was extended at least to Nuremberg, if not beyond. The minister believed that it would be most advisable for the

²³ Z. Segal, 'Communication and State Construction: The Postal Service in German States, 1815-1866', *Journal of Interdisciplinary History*, 44, no. 4 (Spring, 2014), pp. 453-73; K. Amtmann, *Post und Politik in Bayern von 1808 bis 1850: Der Weg der königlich-bayerischen Staatspost in den Deutsch-Österreichischen Postverein* (Munich, 2006), pp. 136-245; N. Mayr, 'Particularism in Bavaria: State Policy and Public Sentiment, 1806-1906' (University of North Carolina, Ph.D. Thesis, 1988), pp. 96-187.

government, business, and private individuals to wait until such time as the railway had connected important, and commercial towns.²⁴

King Ludwig I's personal interest in the project appears to have maintained it afloat, but by 1842, the government was met with Steinheil's refusal to cooperate further in the trials. Steinheil's frustration, noted earlier, was also tied to the government's explicit earlier attempts to limit his rights to intellectual property protection. In 1838, the scientist had been denied a wide-reaching *Privilegium* which would have secured his technical competence and financial interest in the matter. Steinheil's trials had continued to help answer the questions posed by the *Eisenbahnbau-Kommission*, but by 1842, he was no longer willing to allow the state to draw benefits from his ideas without due compensation.²⁵ The scientist's personal interests and sphere of expertise had collided with those of the government.

The conflict ultimately turned to Steinheil's advantage. As a member of the *Polytechnische Verein's Centralverwaltungsausschuß*, and by virtue of his position as *Conservator der Akademie der Wissenschaften*, he was well acquainted with the officials who made key decisions on the introduction and patenting of new technologies.²⁶ In the early 1840s, for instance, his colleagues on the *Centralverwaltungsausschuß* included the head of the *Eisenbahnbau-Kommission*, Pauli, and *Generalzolladministrator* Karl von Bever.²⁷ The society itself was a central point of convergence in Bavaria for officials as well as private entrepreneurs who shared an interest in innovation. Aware of his bargaining power, therefore, in July 1844, Steinheil defended his application for a *Privilegium* on the telegraph to his colleague Pauli, on the

²⁴ BHStA, MInn 45175/1, Abel to Ludwig I, 12th May 1841.

²⁵ BHStA, MInn 45175/1, Regierung Oberbayern to MInn, 7 Aug. 1842.

²⁶ Donald E. Thomas, 'Der Polytechnische Verein in Bayern (1815-1933)', *ZBLG*, 64 (2001), p. 440.

²⁷ 'Verzeichnis der Mitglieder des Polytechnischen Vereins', *KGB*, 19 (1841), Beilage, pp. 35-6.

grounds that his invention was increasingly endangered ‘from abroad’, and that he deserved remuneration for his efforts.²⁸

In the meantime, Pauli and his commission examined other potential directions for the development of telegraphy. A proposal for a ‘marine telegraph’ based on that used in Bremen had been put forward, for instance, and the Lindauer-Dampfboot Aktiengesellschaft suggested that an analogous system be used on the Bodensee. The idea was swiftly rejected.²⁹ Before long, the absence of Steinheil’s expertise in the field was felt, and in 1844 Pauli recommended that the professor’s advice be sought on methods of signalling.³⁰ The cost, it seems, was the granting of a five-year *Privilegium* on the invention, which was finally handed over on 30 August 1844.³¹

Across Germany, meanwhile, other telegraph apparatuses and systems were now being trialled along a number of railways. At the time of Steinheil’s stand-off with the state, the Mannheim-based Anglo-German engineer William Fardely wrote to King Ludwig I with such a proposal. Raising the monarch’s expectations with the now standard reference to his apparatus’ ability to transmit entire words ‘at the speed of thought, through space and time’, he proceeded to describe the far more concrete, rather less romantic applications of the technology which he had in mind. Put simply, his telegraph would enable railway personnel constantly to be informed as to the whereabouts of trains along their single-track lines. Thus able to coordinate the passage of different trains, the state would be spared the need to construct double sections of

²⁸ BHStA, MHI 16863, Steinheil to Pauli, 3 July 1844.

²⁹ BHStA, MInn 45175/1, Regierung Schwaben und Neuburg to MInn, 14 Dec. 1843.

³⁰ BHStA, MHI 16863, ‘Bericht der Eisenbahnbau-Kommission’, 25 April 1844.

³¹ ‘Bekanntmachung von Gewerbs-Privilegien’, *KGB*, 23 (1844), p. 791.

track along the entirety of their railway lines, except in those places where two trains might be required to meet.³²

The king appears not to have taken up Fardely's offer, but his installation was soon being trialled in the region of Frankfurt-am-Main along the private *Taunus-Eisenbahn*.³³ Around the same time, David Hansemann insisted that a telegraph system be introduced along the segment of his railway connecting Aachen and Ronheide.³⁴ By 1845, trials were taking place along the two first railway lines in Württemberg, a first trial was underway along the *Kaiser Ferdinands-Nordbahn* near Vienna, and private railway companies throughout Prussia soon requested permission to construct their own telegraph lines.³⁵

As in Bavaria, state commissions were established in parallel to these private initiatives, creating friction between the interested parties. In 1844, Major O'Etzel's *Telegraphen-Kommission* had been established under the auspices of the Ministry of War, and it had begun conducting trials between Berlin and Potsdam in collaboration with a clockmaker, Ferdinand Leonhardt.³⁶ Similarly, in Austria Major von Mayern, head of the state's optical telegraph line was charged with inquiring into the trials which had been undertaken along the *Kaiser Ferdinands-Nordbahn*. The operating company's adviser, Andreas Baumgartner was then chosen to head the state's own telegraph department.³⁷ In Baden, the physics teacher and *Hofrat* Wilhelm Eisenlohr proposed

³² BHStA, MInn 45175/1, William Fardely to Ludwig I, 30 June 1843.

³³ Horst A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland und die rheinische Industrie : von den Anfängen bis zum Ausbruch des Ersten Weltkrieges* (Wiesbaden, 1983), pp. 133.

³⁴ *ibid.*, 149.

³⁵ *ibid.*, 45; Lobentanz, 'Zur Geschichte', p. 15; W. Löser, 'Die Rolle des preußischen Staates bei der Ausrüstung der Eisenbahnen mit elektrischen Telegraphen in der Mitte des 19. Jahrhunderts', *Jahrbuch für Wirtschaftsgeschichte*, 4 (1963), p. 198.

³⁶ Wessel, *Die Entwicklung*, p. 150.

³⁷ Lobentanz, 'Zur Geschichte', pp. 16-27.

similar trials along the state railway.³⁸ Across Germany, therefore, states drew upon their own personnel, but also turned to experts or professionals within society for help in developing the technology.

In Bavaria, the government's move to take ownership of the railways seemed to remove its conflict with the companies, but had left it at the mercy of Steinheil, upon whose expertise it depended. In Prussia and Austria, on the other hand, the persistence of combined public and private involvement in the railway industry created tensions of its own. 'It has already become urgent to consider this matter seriously', Mayern in Austria asserted. 'Certain things which are to be [*die einmal sein müssen*], will be. If one does not take care of them, they will crop up like weeds. Such is the case of telegraphy for us'.³⁹

Both states had established optical telegraph lines in the past, and these had been under the sole authority of the state. For Mayern, this monopoly over the circulation of information was now in jeopardy. 'The *Aktiengesellschaft* of the *Nordbahn* has decided to erect a galvano-magnetic line alongside the railway. It has already begun', he wrote. 'Certainly we cannot believe that we will let things go along as they please, and that the state will forego its prerogative as though nothing were thereby lost, in favour of the plutocrats'.⁴⁰

'It is claimed', he continued, 'that "this telegraph is only for the purposes of the railway service". But it can speak as it chooses, and so, were there a disturbance in Prussia or an uprising in Bohemia, Your Excellency would have to turn to Baron

³⁸ Wessel, *Die Entwicklung*, p. 58.

³⁹ Lobentanz, 'Zur Geschichte', p. 16.

⁴⁰ *ibid.*, p. 17.

Rothschild in order to find out how things stand out there'.⁴¹ Although the aims of the state and of the railway companies were complementary in technical terms, therefore, this interdependency was also a source of tension.

Similar misgivings were expressed within the Prussian government. In June 1846, in view of the growing number of railway companies conducting telegraph trials, Friedrich Wilhelm IV had already informed his finance minister Eduard Heinrich Flottwell that 'this cyphered language (*Zeichensprache*) appears just as important for the government as it is dangerous in the hands of private individuals, and must not therefore be left over to private industry'.⁴²

In both Prussia and Austria, the solution appeared to be a system of concessions, whereby telegraph wires were to be built along private railway lines under certain conditions, which ensured the state's ability to control their usage. From January 1847, it was announced that in Austria, 'given the importance which telegraphic connections have for the public administration [...] from now on no private individual nor any association will be given authorisation to construct telegraphs without first obtaining permission from the Kaiser himself'.⁴³

In the 1960s, Wolfgang Löser analysed the discussions which had taken place in Prussia, seeing in them the signs of a conservative-aristocratic regime's fear of rising bourgeois forces. But the authoritativeness of statements such as Flottwell's belied the state's dependence upon the private sector. In Prussia, for instance, an initial decision to oblige companies to employ civil servants in the running of their telegraph lines was overturned. Early in 1847, the *Telegraphen-Kommission* came to the conclusion that,

⁴¹ Lobentanz, 'Zur Geschichte', p. 17.

⁴² Löser, 'Die Rolle des preußischen Staates', p. 194.

⁴³ *EBZ*, 21 Feb. 1847.

not only would this condition be considered a considerable burden by the railway companies, the state could then also be held responsible for any railway accidents which were linked to signalling errors.⁴⁴

Having considered the matter further, the commission then added that the obligation to employ civil servants would result in companies refusing to build any telegraph lines at all. And yet, as it explained, ‘if they are not built by the companies, then it is unlikely that any will be built for state or public correspondence either’. The commission thereby recognised the limits to the government’s power, and the need to cooperate with the private sector: ‘for the companies have no obligation to allow the state to build telegraphs along their lines, and they would therefore only permit such construction upon onerous conditions’, which would make the undertaking unprofitable and undesirable.⁴⁵ The companies, meanwhile, needed permission from a government as yet uncertain of its attitude to industrial capital. Both cooperation and conflict were practically inevitable.

The conditions which the commission proposed to attach to the government’s concessions were a considerable compromise, and allowed railway companies to use their own employees to operate the telegraph installations. The decision met opposition from within the government, however. For the foreign minister Graf zu Stollberg, these relaxed conditions relinquished security and authority to particularly bourgeois forces: ‘the distinct composition of the railway managements, upon which the government has little influence, and in which one finds many men from the commercial estate (*Handelsstand*) cannot go unnoticed [...]’.⁴⁶

⁴⁴ Löser, ‘Die Rolle des preußischen Staates’, p. 196.

⁴⁵ *ibid.*, p. 197.

⁴⁶ *ibid.*, p. 199.

Pressure was being exerted on both parties. The state, whatever its misgivings, could not expect telegraph lines to be built if it set excessively stringent conditions. For a number of railway companies, on the other hand, the safety and profitability of their enterprise now depended upon this new means of communication. As the finance minister's commissioner explained in July 1847: 'The decision as to the organisation of the state telegraphs could go on for some time yet [...] But for now it is above all a question of establishing the conditions of the concessions as quickly as possible, so that the railway companies might carry out this installation for the improvement of safety of their service before the beginning of winter, as requested by a number of them'.⁴⁷

Across Germany, by 1847 the development of telegraphy had enrolled many different actors, encouraging them to cooperate in the financial, logistical and technical management of the process. As they had done so, however, they had also sketched out the boundaries separating their respective spheres of interest, authority and expertise, and the friction between them was soon to become problematic.

The Landscape of Innovation

It was through the regional newspaper, the *Allgemeine Zeitung*, that Bavarian Minister of the Interior Abel had learnt of the installation of Cooke and Wheatstone's telegraph on the Great Western Railway in Britain in 1838. Noting the similarities in both construction and purpose between the British invention and Carl Steinheil's, he asked Friedrich August von Gise, the foreign minister, to obtain as much information as possible on the topic from the Consul in London.⁴⁸

⁴⁷ Löser, 'Die Rolle des preußischen Staates', p. 201.

⁴⁸ BHStA, MInn 45175/1, Abel to Gise, 14 Dec. 1839.

A few years later, the king himself similarly read in the *Allgemeine Zeitung* of a trial carried out in Paris, and ordered his ambassador to France to gather reports on the details of its construction.⁴⁹ This time, chief engineer Pauli of the *Eisenbahnbau-Kommission* was charged with investigating the trials in question. As he explained to Abel, the purpose of the French telegraph was still primarily railway signalling – though ordinary correspondence might, in theory, be possible in future. For now, he recommended pursuing the tests under way along the Munich-Augsburg line, with the help of ‘expert physicists’ – Steinheil in particular – ‘so that Bavaria may not lag behind other countries in the practical implementation of this important achievement of science’.⁵⁰ Forwarding Pauli’s report, the minister in turn called for haste: the telegraph was well and truly established in England, and it was now also in operation between Paris and Versailles, as well as St-Germain. Even the Austrian government was planning a number of railway telegraph connections, he explained.⁵¹

It was this combination of exchange via public and diplomatic channels, of technical inquiry, scientific expertise and administrative encouragement that stimulated and supported the development of the telegraph. By these means, the information was circulated which facilitated the cooperation of the state and private actors. Across Germany during the 1840s, a growing number of channels were available through which this information could be obtained, discussed, modified and in turn put forward for deliberation. It passed through the hands of scientists, engineers, entrepreneurs and civil servants alike, connecting the many ‘hubs’ of knowledge production and consumption to which they belonged. ‘Useful knowledge’ was shared in newspapers

⁴⁹ BHStA, MH 16863, MA to Gesandtschaft Paris, 7 June 1845.

⁵⁰ BHStA, MH 16863, Pauli to Abel, 17 Oct. 1845.

⁵¹ BHStA, MH 16863, Abel to Ludwig I, 13 Jan. 1846.

and periodicals, in face-to-face interactions and institutions scattered across a broad landscape of innovation, as the contours of a new field of expertise began to emerge.

The well-documented initiatives of the Prussian government to recuperate the region's 'backwardness' in relation to Western European industrialisation had long involved strategies of 'technology transfer' from its neighbours. Whether by means of espionage and official visits, or by subsidising apprenticeships abroad for students of state institutions such as the *Gewerbe-Institut*, vehicles had been sought for the importation of knowledge and materials.⁵² The practice certainly continued in the 1840s, and Prussian and Bavarian embassies across Western Europe were repeatedly called upon in this way to obtain information locally on the development of the telegraph.⁵³ Despite the considerable amount of home-grown talent in this field, indeed, England remained a source of inspiration, and the prime destination for technological pilgrimages.

Notwithstanding Steinheil's own innovations in Bavaria, for instance, and no doubt due to the difficulties he had subsequently caused the government, Friedrich August Pauli travelled to England in 1843/4 and reported back that Wheatstone's invention there had been 'brought to a level of perfection, which leaves little more to be desired'.⁵⁴ In the summer of 1845, Johann Wilhelm Wendt, the captain, entrepreneur and engineer behind Bremen's trials in electrical telegraphy made his second journey to England for the same purpose.⁵⁵ A few years later, *Hofrat* Wilhelm Eisenlohr was sent

⁵² W. Weber, 'Preussische Transferpolitik 1780 bis 1820', *Technikgeschichte*, 50 (1983), pp.181-196; W. Weber, 'Industriespionage als Technologie Transfer in der Frühindustrialisierung Deutschlands', *Technikgeschichte*, 42 (1975), pp. 287-305.

⁵³ The Prussian reports, for instance, are collected in: GStA I.HA Rep.120 HA Handelsamt, Nr.179.

⁵⁴ BHStA, MH1 16863, Abel to Ludwig I, 13 Jan. 1846.

⁵⁵ StAB, 2-R.15.b.1, Petition to Senat, 28 Oct. 1845.

from Baden to discuss telegraphy with Charles Wheatstone himself.⁵⁶ Not all pilgrims travelled with the support or on behalf of state institutions, however: the Anglo-German engineer William Fardely, for his part, had moved to England in 1840 specifically for the purpose of training as a ‘telegraph engineer’, and published a translation of some of Wheatstone’s work upon his return in 1844.⁵⁷

The flow of information from abroad was also supported by a growing literature on the topic. The role of the *Allgemeine Zeitung* in spurring the Bavarian authorities to emulate developments abroad, for instance, hints at the increasingly open market on which ideas were now exchanged. The point was expressed to the Bavarian king by his envoy, Graf von Luxburg, when he expressed his admiration for the new technology: ‘These new telegraphic means of connection transmit messages to and from the furthest points with the speed of a lightning bolt’. Assuming that the king must already have ordered his administrators and technicians to collect information on all new inventions and discoveries in the field of railway construction, as well as to submit all relevant literature and newspaper articles to expert examination, he added: ‘In this regard, secrecy rules nowhere, everything is accessible to everyone [!]’⁵⁸

The information they sought was certainly out there, as a periodical culture strengthened its hold on the practices of scientific communication.⁵⁹ In particular, *Dinglers Polytechnisches Journal* was a crucial vehicle for foreign knowledge into the

⁵⁶ R. Seidel, ‘Verkehrsmittel Telegraph: Zur Geschichte der Telegraphie im 19. Jahrhundert bis 1866 unter besonderer Berücksichtigung des Raumes Hannover – Bremen’ (University of Hanover PhD Thesis, 1980), pp. 142-4.

⁵⁷ V. Aschoff, *Geschichte der Nachrichtentechnik*, vol. 2, *Nachrichtentechnische Entwicklungen in der ersten Hälfte des 19. Jahrhunderts*, 2nd ed. (2 vols., Berlin, 1995), ii., 173-180.

⁵⁸ BHStA, MHI 16863, Graf von Luxburg to Ludwig I, 16 June 1845.

⁵⁹ Christina Jungnickel and Russell McCormach, *Intellectual Mastery of Nature: Theoretical Physics from Ohm to Einstein* (2 vols., Chicago, 1986), i., pp. 34-9, 114-28; L. U. Scholl, *Ingenieure in der Frühindustrialisierung: staatl. u. private Techniker im Königreich Hannover u. an d. Ruhr (1815-1873)* (Göttingen, 1978), p. 274; F. Fischer, ‘Dinglers Polytechnisches Journal Bis zum Tode seines Begründers (1820–1855)’, *Archiv Für Geschichte Des Buchwesens*, vol. 15 (2007), pp. 1027–1142, here, pp. 1029-36.

German-Speaking world. Of the 64 articles on telegraphy which it published between 1840 and 1847, just over half (33) were drawn from British journals, in particular the *Mechanics' Magazine*. A further eighteen were taken from French journals, among which the *Echos du monde savant*, the *Comptes rendus*, and the *Moniteur industriel*. As far as can be ascertained, only nine articles were either purpose-written or drawn from another German-language source. All nine articles in question dealt with developments occurring in Germany itself, or with German individuals' contributions to the technology.⁶⁰

On one hand, this bias was partly a result of the editor's decision to focus on providing access to those sources most difficult for its readers to obtain, and only since the late 1830s had *Dinglers* begun to rely on German sources for its articles.⁶¹ On the other hand, the disproportion also supports the argument that by the early 1840s German technical literature lacked not so much in variety of broad publications as in a significant number of original contributions.⁶² The journal also served more practical purposes, in that it regularly recorded patents which were issued on inventions abroad. In its early years, these had constituted its main source of information on technological developments outside Germany.⁶³ Over time, however, they also enabled keen German innovators to evaluate their potential markets – it was widely held, for instance, that England liberally granted patents to foreign as well as native inventors.⁶⁴

The information contained in periodicals such as *Dinglers* was also collected in particular sites. The Prussian *Technische Deputation*, for instance, bore responsibility

⁶⁰ These figures were established on the basis of the contents listings, and an overview of each volume of *DPJ* between 1830 and 1880 (vols. 35-238).

⁶¹ Fischer 'Dinglers Polytechnisches Journal', pp. 1040-3, 1080-2, 1092.

⁶² *ibid.*, p. 1095.

⁶³ Fischer 'Dinglers Polytechnisches Journal', p. 1089.

⁶⁴ *ibid.*, p. 1089.

for the evaluation of patent applications sent from any private citizen. In the early 1840s, the *Deputation* received applications from foreign agents requesting permission to import telegraph apparatuses, but also proposals for innovations in telegraphy from merchants and even high school teachers such as August Kramer in Nordhausen.⁶⁵ When evaluating these applications, officials could turn to an extensive literature contained in its library, of which a catalogue published in 1853 gives an outline. The ‘*Repertorium der technischen Literatur*’ lists 113 journals published between 1823 and 1853, containing articles on an enormous variety of topics.⁶⁶ The *Deputation* had become a crucial hub in the Prussian and German landscape of innovation, a repository of knowledge and a nexus between the state and amateur or professional inventors within society.

Of the journals recorded in the *Repertorium*, around 49 were German-language publications (including Austria-Hungary and Switzerland), and 64 were published both abroad and in a foreign language.⁶⁷ Britain and France were the most important source of foreign journals, with 27 and 25 publications respectively, followed far behind by francophone Switzerland (five publications) and the USA (four publications).⁶⁸ Over the period 1823 -1853 covered by the catalogue, a total of 190 articles were recorded under the heading ‘*Telegraphie*’. Of these, as far as can be confirmed, 85 were published exclusively in foreign-language journals. A further 67 were published in both German-language and foreign journals, primarily British and French publications. *Dinglers* had

⁶⁵ See the reports in GStA, I.HA Rep.120 MfHuG, D XIV 2, Nr.16, Bd.1-9.

⁶⁶ E. L. Schubarth (ed.), *Repertorium der technischen Literatur, die Jahre 1823 bis 1853 einschl.. umfassend* (Berlin, 1853), pp.iii-xvi.

⁶⁷ *ibid.*

⁶⁸ *ibid.*

published 54 of these, further confirming its importance in the transmission of news from abroad. 152 of a total of 190 articles were thus almost certainly of foreign origin.⁶⁹

Only 38 articles appear to have been drawn exclusively from German sources, usually other journals or newspapers, or purpose-written pieces. Narrowing down the interval to the period 1823-1847, however, we find that only 9 articles were of exclusively German origin, the remainder published between 1847 and 1853.⁷⁰ Despite the various trials taking place in Germany at the time, therefore, publications on the topic appear to have been more widespread in Britain and France at an earlier date.

Overall, the bias in the literature in favour of foreign knowledge was contributing to a perception of backwardness, whatever its basis in reality. In 1847, *Dinglers* reproduced an article which had been published in a supplement to the *Allgemeine Zeitung*, and which expressed this ambiguity, both evoking the region's potential head-start in telegraphy, and the implicit anxiety that this advance may be lost: 'It is to be hoped that in our time of newly blossoming German national sentiment there will be enough participation in the German spirit of invention and German industriousness in affairs in which our fatherland not only does not lag behind the best of that abroad, but is everywhere well ahead'.⁷¹

In Bavaria too, innovation was supported by a nexus of people and institutions. The *Polytechnischer Verein*, as evoked earlier, was composed of both state officials and private citizens, and was charged with the assessment of patent applications. The society's *Kunst- und Gewerbe-Blatt* served to diffuse knowledge of these patents, as well as other developments which its members found noteworthy. The journal testifies

⁶⁹ Schubarth, *Repertorium*, pp. 874-878.

⁷⁰ *ibid.*

⁷¹ Anonymous, 'Telegraphie in Deutschland', *DPJ*, 105 (1847), pp. 457-459

in particular to Carl Steinheil's active participation in other fields of engineering, and record at least one of the *Privilegien* which he received on optical instruments.⁷² But other sources of advice were also called upon in the government's efforts to develop the telegraph. After reading reports of the Englishman Mr Highton's improvements to the technology in the *Allgemeine Zeitung*, for instance, King Ludwig I asked the *Akademie der Wissenschaften* to inquire into the matter. The newspaper article itself had also referred to reports published in *Dinglers*, in particular.⁷³

The articles which appeared in *Dinglers*, meanwhile, also point to the changing contours of the field of telegraphy. As before, some contributors proposed ambitious innovations to enhance long-distance communication. In 1841, for instance, the Swiss physicist Daniel Calladon hoped to explore further the transmission of sounds through water.⁷⁴ Similarly, in 1846, a certain Romershausen suggested that his 'telephone' – a system based on the transmission of speech through underground tubes – was more secure than electric telegraphs, whose wires could easily be damaged, and that it would be of particular use to 'public and commercial exchanges' [*bürgerlichen und commerciellen Verkehr*].⁷⁵ Compared with the 1830s, however, the majority of articles had come to focus more specifically on the concrete developments and trials which were taking place in the field of electrical telegraphy throughout Europe and the USA.

Thus, in 1838, *Dinglers* informed its readers of both Steinheil's experiments and Charles Wheatstone's planned trial along the Great Western Railway in London.⁷⁶ Between 1838 and 1845, this was followed up by a further five articles tracing the

⁷² 'Gemeinnützige Mittheilungen und Bekanntmachungen', *KGB*, 14 (1836), p. 340

⁷³ BHStA, MH 16863, Vorstand der Akademie der Wissenschaften to Ludwig I, 4 Feb. 1847.

⁷⁴ D. Calladon, 'Ueber den Schall im Wasser; Ein Schreiben des Hrn. Daniel Calladon an Hrn. Arago', *DPJ*, 82 (1841), pp. 226-230.

⁷⁵ E. Romershausen, 'Über das Telephon', *DPJ*, vol. 99 (1846)pp. 413-15.

⁷⁶ Anonymous, 'Elektrischer Telegraph an der Great-Western-Eisenbahn', *DPJ*, 70 (1838), p. 235; Anonymous, 'Über Steinheil's elektro-magnetischen Telegraphen mit betreffenden historischen Notizen', *DPJ*, 67 (1838), pp. 388-400.

improvements which Wheatstone and his collaborator Cooke later made to their system. Further reports included descriptions of the American Samuel Morse's telegraph in 1839 and 1846, of the trials conducted on David Hansemann's railway between Aachen and the Belgian border in 1843, of those taking place in France on the Paris-Rouen railway line in 1845, on the experiments taking place in Bavaria, as well as those carried out by William Fardely along the *Taunus-Eisenbahn* in 1846.⁷⁷ Far from purely local events, the results of each one of these developments were communicated to the broader interested public.

Both in Germany and abroad, the vast majority of articles on telegraphy were still published in relatively broad-based, or 'polytechnical' journals. This trend reflected the fluidity of the engineering community only then emerging throughout Europe and America, and the slow onset of professionalisation which only began in the late 1840s and early 1850s.⁷⁸ It also demonstrates that the field of 'telegraphy' remained considerably broad. In Central Europe, the technology was not to obtain a dedicated publication in German until 1854, with the establishment of the *Zeitschrift des Deutsch-Österreichischen Telegraphen-Vereins*. The only two articles published in *Dinglers* between 1840 and 1847 which were drawn from specialist journals, – whether German or foreign – came from the *Archiv für Eisenbahnen*, dedicated to a field which had

⁷⁷ Anonymous, 'Über Morse's elektromagnetischen Telegraphen', *DPJ*, 72 (1839), pp. 221-2; Anonymous, 'Morse's elektromagnetischer Telegraph', *DPJ*, 99 (1846), pp. 48-55; Anonymous, 'Elektrischer Telegraph auf der Eisenbahn von Aachen zur belgischen Grenze', *DPJ*, 89 (1843), pp. 256-6; Anonymous, 'Arago, über elektrische Telegraphen', *DPJ*, 96 (1845), pp. 486-9; Oscar v. Schllerer, 'Über Sicherheitsvorrichtungen an den Ausweichstellen der Eisenbahnen', *DPJ*, 99 (1846), pp. 242-7; Anonymous, 'Der elektrischer Telegraph auf der Taunus-Eisenbahn', *DPJ*, 101 (1846), pp. 478-80.

⁷⁸ K. Gispén, *New Profession, Old Order: Engineers and German Society, 1815-1914* (Cambridge, 1989), pp. 7-56.

already received much greater attention and investment from both the state and the private sector.⁷⁹

As railway engineering was recognised as a field of expertise, telegraphy was given a place alongside it by association. Until the first report of Charles Wheatstone's experiments on the Great Western Railway in 1838, only one mention had been made of the possible use of telegraphy for railways, in 1835.⁸⁰ By the 1840s, the two had become almost indistinguishable, as articles reported either on existing trials along particular railway lines, or on proposals for telegraphic forms of railway signalling. The use of electrical telegraphy for ordinary correspondence was occasionally evoked, but such concerns had taken a back seat. In any case, there was still too little differentiation in the operation of telegraph lines for railway signalling or for ordinary communication – the two aims were complementary. As the railway sector grew in importance, however, and its objectives diverged from those of the state, a further zone of friction would emerge between them.

The apparatuses developed during this period reflected these trends. This was the era of the *Zeigertelegraph*, or pointer-telegraph, developed specifically for its simplicity and ease of use by untrained railway personnel. Although slower than the original needle-telegraphs developed by Cooke and Wheatstone in Britain, even the latter turned to this design in 1840, recognising the greater reliability of the pointer systems. Whilst other 'printing' and 'needle' telegraph apparatuses continued to be developed during the early 1840s, the best-known names in the field – Leonhardt, Stöhrer, Fardely, and Siemens - all also constructed and trialled pointer-telegraphs during this period.⁸¹ When

⁷⁹ Anonymous, 'Cooke's elektro-magnetischer Telegraph', *DPJ*, 89 (1843), p. 317; Anonymous, 'Elektrischer Telegraph auf der Eisenbahn von Aachen'.

⁸⁰ Anonymous, 'Eisenbahnen in Verbindung mit Telegraphen', *DPJ*, 56 (1835), p. 74.

⁸¹ Aschoff, *Geschichte der Nachrichtentechnik*, ii., 162-189

William Fardely evoked the possibility of introducing printing telegraphs more adapted to the use of governments, he added that this was to be an accessory to the signalling mechanisms installed.⁸² It was thus increasingly towards the needs of the railways specifically that attention was directed.

Optical telegraphs, meanwhile, were still in operation, and proposals for their modification and improvement were also put forward. A certain G.A. Treutler, in particular, crops up repeatedly in contemporary literature as well as archival material. Having applied to the Prussian *Technische Deputation* for a patent on his optical telegraph in 1842, his proposal was under consideration two years later.⁸³ In the face of competition from new telegraph mechanisms, even Treutler had now adapted his system to the purposes of railway signalling, and defended its utility for this purpose vis-à-vis the electrical fad.

On the basis of the Prussian *Deputation*'s assessment, Treutler's optical telegraph was in use along the Nuremberg-Bamberg line in Bavaria in 1845, and would continue to arouse interest until the end of the decade.⁸⁴ Even as trials using the electric telegraph continued along the Munich-Augsburg railway in 1846, the Bavarian administration was considering his proposal.⁸⁵ The same year, Treutler published an article in *Dinglers* emphasising the indispensability of optical telegraphs along railways.⁸⁶ The older technology had not yet drawn its last breath, and had been adapted to the needs of the sector most interested in telegraphy.

⁸² BHStA, MInn 45175/1, William Fardely to Ludwig I, 30 June 1843.

⁸³ GStA, I. HA Rep. 120 MfHuG D XIV 2 Nr. 16, BD. 1, 'Patentgesuch', Nov. 1842.; cf. Anonymous, 'Treutler's Tag- und Nacht-Telegraph', *DPJ*, 98 (1845), pp. 417-21.

⁸⁴ BHStA, MH 16863, 'Bericht der Eisenbahnbau-Kommission', 17 Oct. 1845; see also BHStA, MHI 16863, Treutler to Ministerium des Innern, 9 April 1847.

⁸⁵ BHStA, MH 16863, Ministerium des Äusseren to Ministerium des Innern, 6 Feb. 1846.

⁸⁶ G. A. Treutler, 'Über Signale auf Eisenbahnen', *DPJ*, 99 (1846), pp. 84-93.

An expanding knowledge market was thus at the heart of the telegraph's development. Supported by a periodical technical literature in particular, but also by the press, personal travels and channels of diplomatic correspondence, information on the technology circulated between key people and places across Germany, Europe and, to a lesser extent, the United States. As ideas were exchanged, the boundaries of an emerging field came into sharper focus. Initially encompassing the complementary aims of railway signalling and ordinary correspondence, over time distinctions began to emerge between these different areas of specialisation.

Strategies of Innovation: Werner Siemens

The example of the young Prussian lieutenant Werner Siemens' introduction to the field of telegraphy during the 1840s highlights the importance of the links between different sites and actors in this landscape of innovation. Settling at the heart of the vibrant Prussian capital city during the period, he was strategically positioned to establish social connections to the military establishment, to key scientists, tradesmen, and industrial entrepreneurs. He benefitted from the links, but also experienced the tensions between the groups and institutions providing the logistical, financial and technical support for the technology.

Born in 1816, between 1835 and 1838 Werner Siemens was trained as an officer at the *Vereinigte Artillerie- und Ingenieurschule* (VAIS) in Berlin. As a future artilleryman, he was taught a broad range of subjects, from modern languages to the art of military fortifications, but it was his interest in the sciences which proved most fruitful. The VAIS stimulated his engagement in the field, as he was taught by a number of young academics who were later to become eminent professors, including Martin

Ohm, younger brother of the famous physicist, Georg, who had himself taught at the VAIS a few years earlier. Of most importance to Siemens' future career, however, was Heinrich Gustav Magnus, a physicist and future rector of the University of Berlin.⁸⁷ In many ways, therefore, the military school constituted a hub of knowledge in Prussia, fed by the competitive academic job market which led many aspiring professors to tour Germany in search of employment.⁸⁸

When he left the VAIS in 1838, Werner Siemens was stationed in Wittenberg, Magdeburg and Spandau, but he returned to the city for good in 1842. There, he initially remained an active officer in the Prussian artillery regiment, and was thereby once again placed at the heart of a centre of innovation. Indeed, the artillery was the branch of the Prussian army which had first shed its attachment to quasi-feudal visions of medieval warfare and recognised the benefits of 'modern' technology during the 1830s.⁸⁹ Siemens therefore worked with and in close proximity to two commissions involved in technological experimentation: the *Artillerie-Prüfungs-Kommission*, and the department headed by Major O'Etzel, who came to lead the *Telegraphen-Kommission* set up in 1844.⁹⁰

It was through his work on the *Artillerie-Prüfungs-Kommission* during the early 1840s that Siemens came into contact with Ferdinand Leonhardt, the Berlin-based clockmaker, who later also came to work for O'Etzel's commission. As a trained artisan, Leonhardt represented a pool of traditional expertise within society upon which state institutions could draw in their efforts at 'modernisation'. He collaborated with

⁸⁷ W. von Siemens, *Lebenserinnerungen*, ed. W. Feldenkirchen (Munich, 2008), pp. 56-7; Jungnickel and McCormmach, *Intellectual Mastery*, i., 52-8.

⁸⁸ K. Jarausch, 'The Sources of German Student Unrest 1815-1848', in L. Stone (ed.), *The University in Society* (2 vols., Princeton, 1974), ii., 533-70.

⁸⁹ E. D. Brose, *The Politics of Technological Change in Prussia: Out of the Shadow of Antiquity, 1809-1848* (Princeton, 1993), 164-89; Dennis Showalter, *Railroads and Rifles: Soldiers, Technology and the Unification of Germany*, (Hamden, Conn., 1975), pp. 143-60.

⁹⁰ Brose, *Politics*, 170; Wessel, *Die Entwicklung*, p. 150.

Siemens in designing a mechanism to measure the speed of projectiles, and was soon tinkering with an imported model of Charles Wheatstone's telegraph apparatus on behalf of the *Telegraphen-Kommission*.⁹¹

Having until then shown little interest in the matter, in early July 1846 Werner Siemens found himself attending one of the trials which Leonhardt was conducting at the home of *Hofrat* Soltmann, the father of one of his brigade comrades.⁹² Later describing the events of that day to his younger brother Wilhelm, Werner explained that he had 'found Leonhardt in a great scrape, because his newly constructed telegraph was making errors which he couldn't explain. As their cause was immediately clear to me, I showed him how he might avoid them'.⁹³ The events of that day then led Siemens to reflect upon the problems which the clockmaker had been facing, and to develop the *Zeigertelegraph* which would make his name.

At first glance, Siemens thus appears to have operated firmly within the context of state efforts to develop the telegraph, particularly within the military establishment. The trials taking place at *Hofrat* Soltmann's home, however, were the result of a broader exchange of ideas and materials across state and society. In 1841, Soltmann, an apothecary by trade, had applied for and obtained an *Einführungspatent* from the *Technische Deputation* to import Charles Wheatstone's telegraph apparatus from England.⁹⁴ The *Hofrat* had thus been among the many ordinary individuals bombarding the Prussian authorities with proposals and patent requests for innovations in

⁹¹ Siemens, *Lebenserinnerungen*, pp. 83-5.

⁹² *ibid.*, pp. 84.

⁹³ Werner to Wilhelm, 15 Jul. 1846, in C. Matschoß (ed.), *Werner Siemens. Ein kurzgefaßtes Lebensbild nebst einer Auswahl seiner Briefe* (2 vols., Berlin, 1916). (2 vols., Berlin, 1916), i., 16-17.

⁹⁴ GStA, I. HA Rep.120 MfHuG D XIV 2 Nr. 16, Bd.1, 'Patentgesuch Soltmann', 10 May 1842.

telegraphy.⁹⁵ Having no doubt consulted the literature listed in its *Repertorium*, the *Deputation* had approved Soltmann's request.

Siemens, Soltmann and Leonhardt, moreover, were acquainted outside the military establishment. All three were members of the *Physikalische Gesellschaft*, a learned society which had grown out of a circle of young students at the University of Berlin, who regularly gathered at the home of their professor, the physicist Gustav Magnus.⁹⁶ Siemens had himself been taught by Magnus during his days at the VAIS, and upon his return to Berlin he had been invited by his mentor to join the group which formed the *Gesellschaft* in 1845.⁹⁷ Professionally at first, and then socially too, Siemens had thus been tied into networks of scientific exchange.

In addition to these social connections, Werner Siemens plugged into the channels of information circulation. In 1845, for instance, he wrote articles for both *Dinglers* and the prestigious, more academically-oriented *Poggendorff's Annalen der Physik*.⁹⁸ As he explained to his brother, moreover, at the time he observed Leonhardt's telegraph in July 1846 he had 'been working on a history of electrical telegraphy for the annual report of the *Physikalische Gesellschaft*'.⁹⁹ After considering the topic in more depth, he was pleased to announce that 'lo and behold, I arrived at truly brilliant results, which gave me a more secure vision of recasting the whole system'.¹⁰⁰ Siemens' introduction to the field of telegraphy had therefore been the product of the military establishment's technological investigations, of *Hofrat* Soltmann's personal interests, of

⁹⁵ These proposals and requests can be found in the *Geheimes Staatsarchiv*: GStA I. HA Rep.120 MfHuG D XIV 2 Nr. 16, Bd.1.

⁹⁶ W. Schreier, M. Frankeunter, and A. Fiedler, 'Geschichte Der Physikalischen Gesellschaft Zu Berlin 1845–1900', *Physikalische Blätter* 51, no. 1 (1995), p.11.

⁹⁷ Siemens, *Lebenserinnerungen*, 79.

⁹⁸ W. Siemens, 'Ueber die Anwendung des erhitzten Lufts als Triebkraft', in *Gesammelte Abhandlungen und Vorträge* (Berlin, 1881), pp., 1-8; W. Siemens, 'Anwendung des elektrischen Funkens zur Geschwindigkeitsmessung', *ibid.*, pp. 23-32.

⁹⁹ Werner zu Wilhelm, 15 Jul. 1846, in Matschoß, *Werner Siemens*, i., 16-17.

¹⁰⁰ *ibid.*

the *Deputation*'s assessment of the technology, and of the clockmaker Leonhardt's professional expertise, and he was then able to channel his reflections back into the pool of knowledge upon which all depended.

Siemens' telegraph apparatus itself came to join the collection of objects being examined and adapted across Germany. He initially entrusted its construction to the man with whom, arguably, it had been developed – Ferdinand Leonhardt. Yet the clockmaker had also applied for a patent of his own, and was now Siemens' competitor.¹⁰¹ By October 1846, therefore, Siemens complained to his brother that his partner had been absent for six weeks, busy installing his telegraph on the Thuringian railways.¹⁰² As Leonhardt clearly had contracts of his own to fulfil, the partnership was soon dissolved.¹⁰³

The breakdown in relations between Siemens and Leonhardt highlighted the fact that both now operated on a competitive market. From the outset, indeed, Werner had set his sights high, and had intended to hand over all Prussian-related affairs to Leonhardt so as to concentrate on overseas business.¹⁰⁴ To that end, in the summer of 1846, Werner had turned to his brother Wilhelm in London to enquire about existing English patents in telegraphy, particularly those which Professor Wheatstone might already possess.¹⁰⁵ Investigating the conditions for the sale of his apparatus, a few months later, he once again requested that Wilhelm send him 'brochures' about the professor's apparatus.¹⁰⁶

¹⁰¹ GStA, I. HA Rep. 120 MfHuG D XIV 2 Nr. 16, Bd. 1, 'Patentgesuch, F. Leonhardt', 3 Sep. 1846.

¹⁰² SCA, W1590, Werner to Wilhelm, 1 Oct. 1846.

¹⁰³ SCA, W1593, Werner to Wilhelm, 11 Dec. 1846; Werner to Wilhelm, 4 Jan. 1847, in Matschoß, *Werner Siemens*, i., 32.

¹⁰⁴ Werner to Wilhelm, 20 Aug. 1846, *ibid.*, i., 18-9.

¹⁰⁵ Werner to Wilhelm, 15 Jul. 1846, *ibid.*, *Werner Siemens*, i., 17.

¹⁰⁶ Werner to Wilhelm, 19 Nov. 1846, *ibid.*, i., 27.

It was in fact Wilhelm who encouraged his older brother to focus first on Prussia. Writing to Werner in December 1846, he explained that although Britain was very liberal in issuing patents, the result was a situation in which ‘out of the 6,000 patents which are currently valid in England, around 2,000 have any meaning, but barely 60 provide any decent revenue’.¹⁰⁷ Wilhelm suggested instead that Werner focus on Prussia where he was best known, and obtain a contract for the construction of a line. Only then would it be time to apply for foreign patents, ‘particularly in England where the enthusiasm for electro-telegraphy has not yet been aroused [!]’.¹⁰⁸ Eight months later, as Werner’s situation in Prussia began to stabilise, he would once again insist they explore the English market.¹⁰⁹

Even at home, Siemens faced competition. Within weeks of developing his first apparatus, in August 1846, a certain Dr August Kramer made his first, but by no means last appearance on Siemens’ entrepreneurial radar. Kramer, a teacher at a *Gymnasium*, had developed a printing telegraph which was said to perform ‘wonderful things’, and which had gained the approval of the Prussian *Telegraphen-Kommission*’s scientific adviser, Professor Heinrich Wilhelm Dove.¹¹⁰ A few months later, Kramer was presenting his apparatus in Leipzig, to a broad audience of ‘scientifically eminent men, as well as a few railway directors and officials (*Beamten*)’. In a display of his machine’s capabilities, he telegraphed a short poem: ‘*Kleine. Zeichen. in. der. Runde / Geben. Dir. die. sich’re. Kunde / Selbst. bei. Nacht. aus. tiefem. Schlaf / Wecket. Dich. der. Telegraph*’.¹¹¹

¹⁰⁷ Wilhelm to Werner, 22 Dec. 1846, in Matschoß, *Werner Siemens*, i., 30.

¹⁰⁸ Wilhelm to Werner, 22 Dec. 1846, *ibid.*, i., 30.

¹⁰⁹ Werner to Wilhelm, 10 Aug. 1847, *ibid.*, i., 41.

¹¹⁰ Werner to Wilhelm, 20 Aug. 1846, *ibid.*, i., 18.

¹¹¹ *EBZ*, 10 Jan. 1847.

The German market soon also witnessed direct foreign competition, when a certain William Robinson arrived in Hamburg from the United States in 1847 seeking to spark interest in Samuel Morse's telegraph (without, as it turns out, Morse's authorisation).¹¹² He too conducted public experiments, and called for 'companies as well as private capitalists to introduce such telegraphs under his direction'.¹¹³ These competitors were to remain a thorn in Siemens' side, particularly as they began to undercut his prices.¹¹⁴ In this way, the same dynamism which facilitated exchange, discussion and technical improvement in the field also produced competition, accompanied by all the benefits and tensions with which it is associated.

As long as state commissions and railway companies pursued broadly the same goal, they provided all the more opportunities for budding entrepreneurs to market their inventions, and Siemens worked the situation to his advantage. On one hand, he set about persuading key members of the Prussian *Telegraphen-Kommission* to invest in his telegraph apparatus, and Major O'Etzel became his 'protector'.¹¹⁵ Siemens was also invited to present a lecture on telegraphy to the Chief of the General Staff, Wilhelm Krauseneck, and he eventually claimed that Friedrich Nottebohm, the government assessor, remarked of his apparatus that 'one could not imagine the extent of [its] future progress, and that one could safely assume that it would soon win out over all the others'.¹¹⁶ As Nottebohm was the head of the patent commission, by August 1847

¹¹² F. Pichler, 'Digitale Kommunikation in der K.K. Monarchie: Die Errichtung der elektrischen Telegrafie in Österreich um 1850', *Elektrotechnik und Informationstechnik*, 121, no. 1 (2004), pp. 17-22.

¹¹³ *EBZ*, 18 Jul. 1847.

¹¹⁴ Werner to Wilhelm, 5 July 1847, in Matschoß, *Werner Siemens*, i., 37.

¹¹⁵ Werner to Wilhelm, 25 Jan. 1847, *ibid.*, i., 34.

¹¹⁶ Werner to Wilhelm, 13 Jul. 1847, *ibid.*, i., 40.

Siemens could assert that he was ‘protected by my patent and my influence, which is already quite significant’.¹¹⁷

On the other hand, he also entered into negotiations with different railway companies, including the Berlin-Anhalt line, on whose board of directors Nottebohm also sat.¹¹⁸ Obtaining firm guarantees on a competitive market came with pressures of its own, however, and Siemens once complained that during the summer his ‘contraption may well be gaining increasing recognition every day, but nothing is leading to contracts, principally because the Lord Directors are at the baths’.¹¹⁹ As a field of opportunities opened up ahead of him, Siemens now warned his brother that ‘we should no longer allow ourselves to embark on many more fantasies, rather we must hold the sparrow firmly in our hands’.¹²⁰

It was also by means of literal competition and public confrontation that Siemens was able to secure his apparatus’ position on the private and state market. A trial conducted along the Berlin-Potsdam railway by the *Telegraphen-Kommission*, for instance, confirmed that his model was not only more efficient, but also faster than that of his former partner, Leonhardt.¹²¹ At the same time, Siemens himself chose to spark a ‘polemic’ over his telegraph, by means of a presentation he gave at the *Polytechnische Gesellschaft* in Berlin. The society, which was composed of local entrepreneurs, and was independent of the state, had provided a forum in which to publicise his work, and he expected the ‘polemic’ to be played out in the press.¹²² ‘[T]his is the only means of

¹¹⁷ Werner to Wilhelm, 25 Aug 1847, Matschoß, *Werner Siemens*, i., 43.

¹¹⁸ Werner to Wilhelm, 5 July 1847, *ibid.*, i., 37.

¹¹⁹ SCA, W1071, Werner to Wilhelm, 10 Aug. 1847.

¹²⁰ Werner to Wilhelm, 25 Aug 1847, Matschoß, *Werner Siemens*, i., 45.

¹²¹ Werner to Wilhelm, 9 Jul. 1847, *ibid.*, i., 38.

¹²² Werner to Wilhelm, 10 Aug. 1847, *ibid.*, i., 41; I. Mieck, *Preussische Gewerbepolitik in Berlin, 1806-1844* (Berlin, 1965), p. 162.

countering the attacks from others', he explained, aware that public discussion and competition were the best means of securing interest in his product.¹²³

But changes in the field also began to create difficulties for Siemens, as apparatuses built for the purpose of railway signalling increasingly differed from those designed for ordinary correspondence. In dire need of lucrative contracts, in July 1847 he decided to set aside the construction of a printing mechanism which he had initially hoped might compete with existing models, and to focus on his contracts with the railway companies. Producing the printer, he explained, would 'cost time, which would be useless now, as the railways can make no use of printing'.¹²⁴ The distinctions which had emerged between the different purposes of telegraphic communication had disrupted his project of innovation.

By October 1847, Siemens had established his own independent business. Having fallen out with Leonhardt, it was once again in the *Physikalische Gesellschaft* that he found his long-time partner, Johann Georg Halske, with whom the firm of Siemens & Halske was established.¹²⁵ The young entrepreneur recognised that telegraphy was still in its infancy, and could no doubt foresee its future diversification. Seeking to ensure his ability to benefit in future from as broad a spectrum of investors, therefore, he specifically chose to establish his company as a '*Maschinen-Bauanstalt*', using the rather vague term 'in order to keep our hands completely free'.¹²⁶

Navigating between the important sites within the landscape of innovation by means of his social contacts and of the knowledge circulating between them, Siemens had established a solid foundation for his now world-renowned business. His example

¹²³ Werner to Wilhelm, 10 Aug. 1847, in Matschoß, *Werner Siemens*, i., 41.

¹²⁴ Werner to Wilhelm, 5 July 1847, *ibid.*, i., 37.

¹²⁵ E. Du Bois-Reymond, 'Nachruf an Johann Georg Halske', *Verhandlungen der Physikalischen Gesellschaft zu Berlin im Jahre 1890*, 10 (1891), p. 42.

¹²⁶ Werner to Wilhelm, 25 Aug. 1847, in Matschoß, *Werner Siemens*, i., 42.

demonstrates how developments in the field of telegraphy derived not from a single invention or initiative. They were the product of exchange, cooperation and confrontation between railway companies, scientists, inventors, and administrators dispersed across Germany and beyond.

The Case of Bremen

In Bremen, where interests were more closely aligned, the confrontation of ideas produced fewer tensions, and brought plans for a telegraph line more directly to fruition. The need for improved communication between the city and its harbour in Bremerhaven having been acknowledged during the 1830s, once electrical telegraphy had become the object of discussion across Germany and Europe, public and private interests were more easily accommodated in order to facilitate its introduction. Whilst deliberations taking place elsewhere between 1840 and 1847 generated friction between the actors involved, in Bremen they led to the establishment of Germany's first publicly accessible electric telegraph line.

In August 1845, a circular soliciting support for the establishment of a *Telegraphen-Verein* was issued to unknown addressees, most likely members of the *Bremer Börse*. The author, presumably the captain and engineer Johann Wilhelm Wendt, intended for the association to invest in, and derive profit from the building of an electric telegraph line between Bremen and Bremerhaven. The proposal repeated the arguments put forward a few years earlier by Johann Schmidt, referring primarily to the recognised importance of improving communication between Bremen and Bremerhaven.¹²⁷ Like Schmidt's proposed optical telegraph in 1838, which was

¹²⁷ StABn 2-R.15.b.1, Circular (untitled) Aug. 1845.

currently in operation between Hamburg and Cuxhaven, the Bremen-Bremerhaven electric telegraph connection was primarily intended for the use of the city's merchants and ship-owners. As we have seen, the earlier initiative had failed to raise the expectations necessary to attract sufficient interest and investment.

This time, however, the author could point to developments elsewhere in support of the idea. In fact, the author believed he could 'presuppose that it is now well-enough known to you how many applications of the electromagnetic telegraph have been made in recent times'.¹²⁸ Clearly, Wendt's assumption was justified, as in October 1845 a group of eighteen individuals presented their request to the *Senat* for a concession allowing the newly constituted *Telegraphen-Verein* to construct the Bremen-Bremerhaven line. These members of the city-state's merchant community confirmed the existing, and ever growing 'necessity' (*Nothwendigkeit*) of ensuring 'uninterrupted' communication between the two towns, given the growing importance of Bremen's trade and shipping.¹²⁹ Their address also referred to the 'most astonishing results' of the experiments conducted by Gauß and Steinheil, which had 'already resulted in the abandonment of the former semaphoric telegraph in a number of countries, namely England, France and the United States of North America'.¹³⁰

Where expectation had failed to stimulate support in the 1830s, widespread knowledge of recent achievements in the field of electrical telegraphy now ensured that these individuals could make the leap of faith required to invest in the technology. Explicitly comparing the latest innovation with Johann Schmidt's earlier proposal, the petitioners pointed to the atmospheric conditions which rendered optical telegraphy impotent at the very moments when the dangers of navigation along the Weser were

¹²⁸ StABn 2-R.15.b.1, Circular (untitled) Aug. 1845.

¹²⁹ StAB 2-R.15.b.1, Supplikat, 28 Oct. 1845.

¹³⁰ *ibid.*

heightened. It was for this reason, they argued, that the earlier project had failed to gain support from the local *Börse*.¹³¹

The *Senat*'s response to the request re-affirmed the mutual interests of the government and its merchant community in the city-state. In particular, the petition found enthusiastic support from Senator Arnold Duckwitz, a driving force in the modernisation of Bremen's infrastructure.¹³² The *Senat* extended its approval of the project, and *Bürgermeister* Smidt underlined the 'important names from our *Börse*' who had signed the petition.¹³³ Whilst the rubbing of public and private interests had caused friction in Prussia, Austria and Bavaria, Smidt understood that the undertaking in fact presented 'absolutely no risk' for the state, and could in fact only benefit the latter, by enabling it not to fall behind other states in the 'acceleration and ensuring of trade and communication'.¹³⁴ The wider context of developments had helped bring together the principal players in the city state's political and economic life.

Indeed, the petitioners counted upon this collaboration to help them avoid the diplomatic obstacles which had further hindered Schmidt's project in the 1830s. They called for the *Senat*'s help in negotiating with the government of Hanover, whose territory the line would have to traverse, in order to persuade it that their enterprise was 'planned in the interest of the common good [and] is distinct from ordinary private speculation'.¹³⁵ Here was also an acknowledgment that concepts of state and society differed in most other German states and that, in the organic vision which prevailed in Bremen, private economic activity could be considered beneficial to the whole. In

¹³¹ StAB 2-R.15.b.1, Supplikat, 28 Oct. 1845.

¹³² StAB, 2-R.15.b.1, 'Extract aus dem Senatsprotocolle', 29 Oct. 1845; A. Duckwitz, *Denkwürdigkeiten aus meinem öffentlichen Leben, von 1841-1866* (Bremen, 1877), pp. 5-75; Seidel, 'Verkehrsmittel Telegraph', p. 185.

¹³³ StAB 2-R.15.b.1, Smidt to Freiherr von Falke, 2 Nov. 1845.

¹³⁴ *ibid.*

¹³⁵ StAB, 2-R.15.b.1, Supplikat, 28 Oct. 1845.

contrast with the rest of the country, in Bremen the first telegraph line was to remain in private hands for much of the nineteenth century.¹³⁶

Bremen was by no means entirely immune to the confrontation and competition between individuals and ideas which were stimulated by the technical literature. As evoked earlier, in Prussia and Bavaria, G.A. Treutler sought to defend his optical telegraph system against the claims of the new technology. In a similar way, Johann Schmidt professed the continued utility of his system in Bremen and Hamburg in the face of emerging competition. In 1844, before the new *Telegraphen-Verein* had come into existence, one article in the *Weser-Zeitung* had already expressed indignation at Johann Wilhelm Wendt's inquiries into the new electric telegraph.¹³⁷ The article engaged a public discussion of the issue, and two further articles were sent in to the newspaper which highlighted the broader implications of each telegraph system for the local economy.

In defence of the electro-magnetic system, one article emphasised its reliability throughout the year, and the uninterrupted service it could provide. The optical telegraph, it argued, being out of action at night and in times of heavy fog, was effectively of use only during a total of three months in the year. The electric telegraph, on the other hand, would enable orders to be sent to the captain of a ship even at 2 am: 'the ship-owner thus lives, so to speak, in Bremerhaven and has unlimited, unhindered control over his ship'. A merchant knew, it continued, what little value unreliable communication had, and the electric telegraph would prevent cases where 'business is forced to stand still'.¹³⁸

¹³⁶ Seidel, 'Verkehrsmitteltelegraph', p. 346.

¹³⁷ StAB, 2-R.15.b.2, *Weser-Zeitung*, 21 Mar. 1844.

¹³⁸ StAB, 2-R.15.b.2, *Weser-Zeitung*, 14 Nov. 1844.

In defence of Schmidt's '*Signaltelegraph*', on the other hand, the author of the second article insisted that, given the new technology's as yet incomplete development, the safest option was to maintain the system which had proven itself over the last five years in Hamburg. Whilst conceding that the *Signaltelegraph* was prone to interference both from lighting and weather conditions, the author questioned the very need for an uninterrupted service. When weather conditions were bad, they argued, or during the night, no ships were likely to be in movement in any case. Foreshadowing the terms of debate which would take place elsewhere in Germany during the 1850s, they insisted that night-time should be reserved – as it always had been – for sleeping.¹³⁹

Yet despite these arguments, the author underscored the shared concern of the partisans of both technologies: the absolute necessity of a telegraphic connection.¹⁴⁰ Eventually, in fact, the *Senat* decided that the concession which it granted to the *Verein* should not be exclusive. In the authorities' view, Schmidt's planned line should be allowed, indeed encouraged to go ahead as it was to offer broader connections with towns along the Elbe as well as Holland, which the electric telegraph line would not. Moreover, it emphasised that 'the majority of our public expects ensuing advantages from the competition between the two institutions, and it can therefore only appear desirable that both should be brought to life as soon as possible'.¹⁴¹ The overlap between government and business in Bremen, a characteristic of the coastal *Hanse* cities richly portrayed in Thomas Mann's *Buddenbrooks*, bypassed the bureaucratic obstacles which slowed down the decision-making process elsewhere in Germany.¹⁴² In theory, at

¹³⁹ StAB, 2-R.15.b.2, *Weser-Zeitung*, 16 Nov. 1844.

¹⁴⁰ *ibid.*; see also Seidel 'Verkehrsmittel Telegraph', pp. 211-214.

¹⁴¹ StAB, 2-R.15.b.1, Smidt to Freiherr von Falke, 2 Nov. 1845.

¹⁴² T. Mann, *Buddenbrooks: Verfall einer Familie* (Berlin, 1901).

least, competition was viewed as a means of obtaining complementary services for the benefit of the community.

The ‘Bremer Telegraphen-Verein’ was finally granted a concession for its project in December 1845, and its statutes were established on 7 May 1846. Whilst the *Senat* reserved the right to inspect the establishment and make use of the technology, the line was to remain under the control of the Verein and was immediately to be opened to the general public, at a rate to be established in the near future.¹⁴³ Given the prominence of the merchant and ship-owning community which had funded the project, the telegraph almost immediately and literally became central to the city’s economic life. Unlike telegraph offices throughout most of Germany, that in Bremen was set up in the *Museum*, in the centre of town, and a stone’s throw away from the town hall, as well as the *Börse* – the heart of trading activities.¹⁴⁴

Although the service was to be open to any member of the public who could afford it, from the outset it relied upon the subscriptions of individual businessmen. Subscribers would receive regular updates on the ships entering and leaving the Weser at Bremerhaven, and benefitted from a discount on the emission of telegrams – a 50% reduction for those paying 10 rf. per annum, and 25% for those paying 5 rf.¹⁴⁵ Before the Bremen-Bremerhaven line was finally opened on 1 January 1847, therefore, the telegraph service had already been set up to develop into a regular component of local economic life.

¹⁴³ StAB, 2-R.15.b.1, ‘Statuten des Bremer Telegraphen-Vereins’, 7th May 1846.

¹⁴⁴ StAB, 2-R.15.b.3, Extract aus dem Senatsprotocolle, 27 Dec. 1850.

¹⁴⁵ StAB, 2-R.15.b.1, Public notice, ‘Bremer Telegraphen-Verein benachrichtigt das geehrte Publikum’, 1 Jan. 1847.

Conclusion

Between 1840 and 1847, the development of electrical telegraphy had necessitated the collaboration of those actors able to support it logistically, financially and technically. Brought together by their shared expectations in the technology, they were struck by a more sombre reality as they set out and compared their interests and objectives.

Their interaction was supported by the multiplication of channels through which knowledge could circulate between state and society, across a broad landscape of innovation which characterised this phase of early industrialisation in Germany. Exchanges between sites and actors helped to shape both the concept and the materialisation of telegraphy, but differences also slowly began to emerge between the technology's different purposes, as greater specialisation set in. It was by connecting to the many available sources of knowledge and investment that the initiatives of entrepreneurs such as Werner Siemens were able to thrive, but even he felt the pressures of incipient differentiation. In Bremen, the close alliance of business and government ensured a smooth passage to the age of electrical telegraphy, but elsewhere in Germany the inevitable friction which developed between science, enterprise and state administrations eventually halted progress. It took the upheavals of the mid-century to resolve some of the tensions which had developed.

Chapter Three: Pressures

The geopolitical consequences of the 1848 revolutions applied the pressure needed to release the tension which had built up between the actors and ideas converging in the development of telegraphy. Over the preceding decade, railway companies and state commissions had worked towards broadly compatible aims, providing diverse markets and opportunities for inventor-entrepreneurs such as Werner Siemens to sell their ideas. Competition had created a dynamic field, in which participants had been able to draw from a common stock of technical knowledge, but as a direct result of this necessary interaction differences had emerged between the interested parties, and by 1847 the tension between them ceased to be productive.

Across most of Germany, progress had stalled. From a technical perspective, the distinction between the kinds of installation required for signalling and correspondence had become too great. Looking back on this decade in 1867, the engineer and director of the Saxon state railways Max Maria von Weber understood the obstacles which had emerged: ‘As surprising as it may seem that such an evidently important means of ensuring the security of railway traffic did not [...] find its way onto every railway line in a short period of time, the reason for this lies in the all too widespread attempt to develop installations which could accomplish different goals at one and the same time, and thereby often achieved none to a satisfactory degree’.¹

Weber was primarily interested in different methods of railway signalling, but the same observation was true of efforts to develop telegraphs for the purposes of correspondence. As it became clear that this objective was attainable, but relied upon

¹ M. M. von Weber, *Das Telegraphen- und Signalwesen auf den Eisenbahnen* (Weimar, 1867), p. 40.

different technical principles, state commissions unleashed yet another seemingly unending cycle of experimentation. Related to this issue was the equally troubling question of logistics and finance. Moreover, if telegraphs could indeed be used for ordinary correspondence, they possessed inherent security implications for the state, and the relationship between governments and railway companies became all the more tense, particularly in the larger states of Austria and Prussia. In Bavaria, meanwhile, the government's dependence upon Carl Steinheil's technical expertise placed it at the mercy of his demands.

Whilst the revolutions of 1848 by no means triggered the actual development of telegraphy, they forced the resolution of many of these issues. The disturbances themselves, and particularly the resurgence of Frankfurt am Main as an active political centre in the German Confederation, encouraged governments to order the immediate establishment of lines of communication across state borders. On one hand, many of the frustrations which had built up during the production process were relieved by the counter-pressure placed upon governments to begin construction. On the other hand, the shift in focus revealed new zones of friction between the governments now having to engage in treaty negotiations. One form of necessary cooperation had been replaced by another, leading once again to the demarcation of spheres of interest, this time between the states themselves.

The negotiations which took place between German governments were influenced by the geopolitical fluctuations resulting from the revolutions. Much of the literature on the events of 1848/9 has naturally been concerned with their impact upon understandings of the German nation, whether in political or cultural terms, and upon

the fate of the liberal movement with which it was associated.² The impact of economic decisions taken at this political juncture upon the course of German industrialisation was also emphasised by the historians William O. Henderson and Theodore Hamerow.³ Indeed, changing attitudes to core economic principles such as free trade were intimately connected to the reconfiguration of liberal ideas at the time. At the intersection between political, economic and social debates, however, transport and communication remain marginalised in the historiography. Yet as will be discussed below, telegraphy became a further field upon which the boundaries and structure of the nation-state could be drawn.

The construction of some of Germany's first telegraph lines during this period played into two crucial aspects of contemporary debates. First, on a practical level, German governments attempted to establish the beginnings of networks across existing borders at the very time that the relations between their states were being put into question by a national assembly. As will be demonstrated in this chapter, their negotiations took account of, and were impacted by the changing function of the provisional '*Centralgewalt*' established in Frankfurt as the political heart of the future nation-state. They thereby further heightened the ongoing struggle between federalist and centralising forces which had long characterised the history of German-speaking Europe, and which reached a milestone in 1848.⁴ Second, the draft constitution prepared by the National Assembly in Frankfurt contained the first systematic consideration of

² B. Vick, *Defining Germany: The 1848 Parliamentarians and National Identity* (Cambridge, MA, 2002); W. Siemann, *The German Revolution of 1848-9*, transl. Christian Banerji (Basingstoke, 1998); J. Sheehan, *German Liberalism in the Nineteenth Century* (London, 1978), pp. 59-76.

³ T. S. Hamerow, *Revolution, Restoration, Reaction: Economics and Politics in Germany, 1815-1871* (Princeton, 1966), pp. 75-196; W. O. Henderson, *The Rise of German Industrial Power, 1834-1914* (Berkeley, 1975), pp. 94-5.

⁴ On the 'federal tradition' in German history see, in particular, the chapters in M. Umbach (ed.), *German Federalism: Past, Present and Future* (Basingstoke 2002); For a critical evaluation of this 'tradition', see A. Green, 'The Federal Alternative? A New View of Modern German History', *The Historical Journal*, 46, no. 1 (Mar., 2003), pp. 187-202.

the relationship between the state and telegraphic communication, and signalled the future direction of government policies.

By 1849, state control of telegraphic correspondence had been established throughout Germany. But it had been asserted through the prism of the debates in the Frankfurt National Assembly and their practical implications. As a result, the mixture of hopes and frustrations which had until then characterised the tense interaction between different state and private contributors to the technology were only briefly side-lined, if at all. Instead, they were now fuelled by pressures exerted upon governments from outside, just as the spectre of domestic consumer demand appeared on the horizon.

The Developmental Deadlock

In many ways, the closing years of the decade constituted a period of accelerated progress in the development of telegraphy. By May 1847, the trials begun three years earlier by the engineer-entrepreneur William Fardely along the private *Taunus-Bahn* near Frankfurt were concluded, and the company's inspector Meller asserted that the telegraph would soon be the 'faithful companion of the railways'.⁵ The utility of the technology to the slowly expanding railway network was now established. On 3 January 1848, the *Eisenbahn-Zeitung* therefore reported that, '[g]iven the importance which this means of communication has already attained, and promises to achieve to a higher degree, given its intrinsic relationship [*Zusammenhang*] to the railway service, it will be our task to pay it our continued attention, and to transmit in these pages all the material concerning it which we are able to collect, insofar as it is informative and interesting'.⁶

⁵ *EBZ*, 30 May 1847.

⁶ *EBZ*, 3 Jan. 1848.

The dynamism of the market which had developed ensured that trials took place across Germany using the different apparatuses proposed by a variety of entrepreneurs. By June 1847, for instance, William Fardely's apparatus had also been tested in Saxony, on the private *Sächsisch-Schlesische Eisenbahn*, and was to be introduced on the Dresden-Leipzig line, as well as the now state-owned *Sächsisch-Bayerische Eisenbahn*.⁷ Further west, Fardely's invention was being tested against the telegraphs constructed by August Kramer and Ferdinand Leonhardt – Werner Siemens' two principal competitors – by the Köln-Mindener Eisenbahn-Gesellschaft.⁸

Another manufacturer, L. Drescher, was due to run trials along the *Ferdinand-Wilhelm Nordbahn*, with the agreement of both the railway company and the government of Kurhessen, through whose territory it ran.⁹ As the results of his trials came through, Drescher also presented a proposal to the Bavarian government for the adoption of his apparatus.¹⁰ In Württemberg, where railways were under the authority of the state, the first operational railway telegraph was introduced in the spring of 1847.¹¹ In Hanover, the state expressed the intention of running trials along the section of its earliest railway line leading to Harburg, and in Mecklenburg, a company envisaged a similar installation on the line between Schwerin and Hagenow.¹² Wherever railways were constructed, it was now expected that telegraph lines would follow, ensuring their smooth and safe operation.

In a similar vein, the success of the telegraphic connection between Bremen and its port in Bremerhaven, opened to the public on 1 January 1847, had created demand

⁷ *EBZ*, 13 Jun. 1847; *ibid.*, 15 Aug. 1847.

⁸ *EBZ*, 19 Dec. 1847.

⁹ *EBZ*, 21 Nov. 1847, p. 382.

¹⁰ BHStA, Verkehrsarchiv 30056, Drescher to Direction, 30 Oct. 1847.

¹¹ F. Weber, *Post und Telegraphie im Königreich Württemberg: Denkschrift aus Anlass des Ablaufs der fünfzigjährigen Verwaltung .des württembergischen Post- und Telegraphenwesens durch den Staat* (Stuttgart, 1901), p. 174

¹² *EBZ*, 17 Jan. 1847; *ibid.*, 19 Sep. 1847, p. 306

for a similar service among the mercantile and shipping communities in its sister city of Hamburg. Although Hamburg possessed an optical telegraph connection to its harbour in Cuxhaven – also run by a private association - the advantages of the system set up in Bremen were increasingly patent.¹³ The parallel interests of the two *Hanse* cities were recognised, and later in the year plans were being drawn up for yet another private enterprise to establish a telegraph line linking Bremen, Bremerhaven, Cuxhaven and Hamburg, to the benefit of these same trading circles.¹⁴

Both the state and the private sector continued to contribute to the technology's overall development, but the distinct aims of the interested parties now threatened to stall its progress. Only in Austria had the haphazard construction of private and state-owned telegraph lines already given way to a more coordinated division of labour. On 16 January 1847, it was established that 'no private party, neither an individual nor a company, will be allowed to establish telegraphs without prior permission from the Kaiser himself'.¹⁵ Somewhat in advance of its German neighbours, moreover, the Austrian government had already begun to establish a number of connections to the important regional centres of the Habsburg Empire. On 23 January 1847, the telegraph between Vienna and Brünn/Brno was demonstrated in front of the Kaiser, and the line would be extended to Prague and operational by November. In the meantime, plans were established to link the capital city to Pressburg, where the Hungarian parliament was due to convene.¹⁶

¹³ StAB, 2-R.15.b.2, *Privilegierte wöchentliche gemmeinnützige Nachrichten von und für Hamburg*, 21 Oct. 1847.

¹⁴ *EBZ*, 1 Aug. 1847.

¹⁵ *EBZ*, 21 Feb. 1847.

¹⁶ G. Lobentanz, 'Zur Geschichte der Telegraphie in Österreich: Von den Anfängen bis ca. 1850' (University of Vienna PhD Thesis, 1967), pp. 28-31.

In Bavaria, on the other hand, friction between the railway company, the government and Carl Steinheil had brought developments to a standstill. At first sight, the nationalisation of the München-Augsburger Eisenbahn-Gesellschaft in 1844 had removed the source of tension between Steinheil and the company's board of directors, both of Bavaria's existing railways were now state owned, and all telegraph trials were under the authority of the *Eisenbahnbau-Kommission* headed by Friedrich August Pauli.¹⁷ Since then, the government had expressed the intention of resuming trials using Steinheil's telegraph installation, and as we have seen, the academic's participation had come at the cost of a patent on his invention. Despite the apparent convergence of logistical, financial and technical interests under a single authority, however, their interlinking had in fact created a deadlock. By early 1846, there was confusion among the administration's engineers as to the progress of the trials ordered two years earlier.¹⁸

In January 1846, therefore, Interior Minister Abel called for these experiments along the Munich-Augsburg railway to be carried out, and for Steinheil to be involved in supervising them.¹⁹ The trials were finally begun in July 1846, but a combination of technical difficulties, hesitation and legal commitments were to hinder the decision-making process. To begin with, some railway personnel had been injured when electricity struck them through the telegraph wires during a thunderstorm. For the following year, Steinheil had attempted to resolve the issue himself, before finally conceding that the best solution would be to adopt a method of wire insulation used in

¹⁷ D. Götschmann, *Wirtschaftsgeschichte Bayerns: 19. und 20. Jahrhundert* (Regensburg, 2010), pp. 58-9

¹⁸ BHStA, Verkehrsarchiv 30056, Erdinger to MA, 20 Feb. 1846.

¹⁹ BHStA, MH 16863, Abel to Ludwig I, 13 Jan. 1846.

Austria.²⁰ A fire then broke out in the Munich railway station, which destroyed the building and brought the trials to an abrupt end.²¹

Despite these obstacles, in June 1847 the Foreign Ministry, under whose authority the technology fell, believed that a satisfactory conclusion had been reached, but that no decisions should be made until the administration had completed its report.²² Although the report highlighted the success of Steinheil's installation as a whole, it nonetheless recommended postponing any final decisions until a number of further technical issues were resolved. In line with the report's recommendations, King Ludwig I ordered that the trials be reprised in June 1847. In November, his personal interest in the matter once again led him to press the administration for updates and results.²³ As the *Eisenbahn-Zeitung* reported, by December 1847 a new railway station had been built in Munich, and trials with Steinheil's telegraph had been reinitiated, but by January, the results remained rather discouraging – weather conditions continued to interfere with the installation, sporadically setting off the telegraph.²⁴

As this cycle of experimentation continued, seemingly incessantly, the minister of the interior pointed out that telegraphy had proved itself in other states where, crucially, additional wires were now being laid for the purposes of correspondence, alongside those intended for railway signalling. In light of this shift in the field, and of the growing importance of telegraphy as a means of regular communication, he recommended calling in an external adviser with the appropriate expertise, who might supervise the introduction of a similar installation in Bavaria. The king not only

²⁰ DMM, FA005/582, Erdinger to Steinheil, 18 Jul. 1846; DMM, FA005/582, 'Bericht des K. Bahnamt München', 18 May 1847. The method in question was the use of porcelain 'bulbs'.

²¹ BHStA, MH 16863, MIInn to Ludwig I, 26 Jun. 1847.

²² BHStA, MH 16863, MA to MIInn, 7 Jun. 1847.

²³ BHStA, MH 16863, MIInn to Ministerial-Referent, 13 Nov. 1847.

²⁴ EBZ, 10 Jan. 1848; BHStA, MH 16863, 'Antrag des Minister des Innern', 8 Jan. 1848.

approved of this decision but, given the successful development of telegraphy in England, suggested that the same system be adopted as there. As his annotation indicated, security concerns were at the forefront of his mind: ‘The telegraph associated with the railways is almost the only means of arresting criminals fleeing the police (the poison is its own antidote). In England it is used with success’.²⁵

Unable to effect the technical shift required to turn the telegraph to more general purposes, the *Eisenbahnbau-Kommission* was sent on a tour of foreign countries so as to determine which system to adopt. Reporting on its observations, the commission considered the advantages and disadvantages of a number of mechanisms developed by William Fardely, the American Samuel Morse, the Scotsman Alexander Bain and the Saxon Emil Stöhrer. Whatever the most desirable apparatus might be, however, the report also specified that their actions were constrained by the terms of the *Privilegium* granted to Steinheil, which explicitly applied to all devices reliant upon the earth as a conductor in the electrical circuit. As this was now common practice, and had been adopted outside Bavaria by numerous innovators, none of the proposed mechanisms could be introduced without infringing Steinheil’s rights. It was therefore recommended that no action be taken until his *Privilegium* became void on 30 August 1849.²⁶

In Prussia, progress had similarly stalled, as the respective responsibilities of the state and companies in constructing and using telegraph lines had yet to be agreed. In June 1847, the *Telegraphen-Kommission* reported that ‘different railway companies, such as the Niederschlesisch-Märkische, the Berlin-Potsdamer-Magdeburger, the Berlin-Hamburger, the Köln-Mindener, and the Stargard-Posener are only waiting for the state

²⁵ BHStA, MH 16863, ‘Antrag des Minister des Innern’, 8 Jan. 1848.

²⁶ BHStA, MH 16863, ‘Bericht der Eisenbahnbau-Kommission’, 12 May 1848.

authorities' permission to make such installations'.²⁷ The conditions, established on 27 August 1847, guaranteed the state the right not only to install wires alongside those of the companies, but also that the latter should be obliged to transmit state telegrams free of charge.

These terms were to be a continued source of tension, and no doubt exacerbated the existing conflicts between the government and the companies suffering from an economic downturn and still reeling from the '*Geldkrise*' of 1844.²⁸ The liberal *Eisenbahn-Zeitung*, edited by Carl Etzel and Ludwig Klein in Württemberg, and now acting as a mouthpiece for the *Verein Deutscher Eisenbahnverwaltungen* expressed the companies' frustration at the situation in Prussia: 'The government is now eagerly pursuing the installation of electro-magnetic telegraphs. It had hoped to attribute the task to the railway companies, but set them such conditions that, we are told, most of them would prefer entirely to abandon such a project. As the state principally hopes to use the telegraph for its own purposes, so it seems natural for it to build them independently and at its own cost, whilst providing for the railways, who give their tracks and other installations for the purpose, a necessary telegraphic connection for their service'.²⁹ A rift had already existed between the parties, and as the uses to which the telegraph was put were more clearly distinguished they began to part ways.

Similar tensions underlay the relationship between state and private actors elsewhere in Germany. In Hessen, for instance, the trials which had been undertaken using Drescher's telegraph apparatus were abandoned when the government insisted that telegraph lines, established at the expense of the railway company in question, were

²⁷ W. Löser, 'Die Rolle des preußischen Staates bei der Ausrüstung der Eisenbahnen mit elektrischen Telegraphen in der Mitte des 19. Jahrhunderts', *Jahrbuch für Wirtschaftsgeschichte*, vol. 4 (1963), pp. 196-198

²⁸ J. M. Brophy, *Capitalism, Politics, and Railroads in Prussia, 1830-1870* (Columbus, 1998), pp. 42-9.

²⁹ *EBZ*, 14 Nov. 1847.

to remain in its hands. As the *Eisenbahn-Zeitung* reported, criticising the decision, ‘this condition convinced the company to forego the electric telegraph altogether, and to settle for now on exchanging hand signals from one railway operator to another’.³⁰ The cooperation which had prevailed in the early 1840s had begun to unravel.

On 16th March 1848, two days before the eruption of hostilities in Berlin, the Prussian finance minister Franz von Duesberg moved to defuse the situation. For the sake of expediency, the Niederschlesisch-Märkische Eisenbahn-Gesellschaft was permitted to install a telegraph without respecting all the conditions imposed.³¹ The logistical separation of railway and state telegraphy had begun, although the Prussian *Telegraphen-Kommission* had yet to answer a number of technical questions.

A year earlier, whilst debate raged over the Prussian concessions, Werner Siemens had been busy attempting to establish his reputation with both the *Telegraphen-Kommission* and the railway companies hoping to establish telegraphs along their lines. By now, he was convinced that he had made a considerable impression upon ‘high society’, and when he later looked back on the situation in his memoirs, he believed his chances of obtaining a position as future director of the state’s telegraph line at this stage had been almost guaranteed.³²

Yet the commission was also assessing other options. The apparatuses constructed by Siemens’ competitors Ferdinand Leonhardt and August Kramer were still under consideration. Along the Cologne-Minden railway line, for instance, it had been determined that Leonhardt’s was best.³³ In late 1847, therefore, the commission decided to set up a contest between a number of telegraph apparatuses drawn from across the

³⁰ *EBZ*, 11 Sep. 1848.

³¹ Löser, ‘Die Rolle des preußischen Staates’, p. 204.

³² W. von Siemens, *Lebenserinnerungen*, ed. W. Feldenkirchen (Munich, 2008), p. 99.

³³ *EBZ*, 28 Feb. 1848.

world, in order to select the one which they should introduce. The competition, by a twist of fate, was to take place in March 1848. As far as Siemens was concerned, however, it was a mere formality, and would serve primarily to guarantee that he received contracts from the state, ‘without appearing to constitute both judge and jury’.³⁴

Having initially sought to take advantage of a vibrant market, Siemens now struggled to juggle his different potential contracts with the state and private railway companies. Writing to his brother around this time, Siemens explained his situation: ‘As I don’t want to lose the state telegraph (postal telegraphy throughout Prussia) out of my hands, I have little or no time at all left for the installation of railway telegraphs here, nor for foreign matters’.³⁵ As the needs of his potential clients diversified, what had initially presented itself as a multitude of opportunities now began to constitute a challenge.

Initially, the disturbances which erupted in Berlin in March 1848 served only to enhance the atmosphere of uncertainty. Werner, who witnessed the events in the capital city and wrote to his brother of the pride he felt at the protesters’ composure, was nonetheless left in the dark as to the competition which had been planned for that month.³⁶ Although the telegraph commission was by no means dissolved, all activities – as far as Siemens was aware – had been suspended. The Siemens & Halske manufacture, meanwhile, continued to turn out apparatuses during this period, but

³⁴ Werner to Wilhelm, 6 Nov. 1847, in C. Matschoß (ed.), *Werner Siemens. Ein kurzgefaßtes Lebensbild nebst einer Auswahl seiner Briefe* (2 vols., Berlin, 1916), i., 47.

³⁵ Werner to Wilhelm, 20 Dec. 1847, Matschoß, *Werner Siemens*, i., pp. 49-51.

³⁶ Werner to Wilhelm, 20 Mar. 1848, *ibid.*, pp. 53-4.

without receiving any firm orders, and Werner waited in vain for a posting in his capacity as lieutenant.³⁷

With the prospect looming of conflict between Denmark and Prussia, Siemens appeared literally to abandon his efforts. Having communicated with his sister and brother-in-law in Kiel where the threat of war was acutely felt, Siemens' sense of duty, national pride and concern for his family led him to travel to the northern coast. The outbreak of hostilities also provided him with another opportunity for publicity as well as to exercise his technical curiosity, however: he proposed, constructed and laid the first recorded set of electrically detonated naval mines, in defence of Kiel harbour.³⁸

Back home, meanwhile, despite the temporary hiatus in the telegraph commission's activities, the contest which had been ordered for the 15th March 1848 was not, as Siemens surmised, 'brought to an abrupt end'.³⁹ A report from the commission, presented on 13 June 1848, indicates that the trials did indeed take place. The conditions in which they were conducted, however, also helped determine the commission's choice in Siemens' favour. As the report indicated, the disturbances had led a number of foreign competitors to withdraw from the competition, leaving Siemens to face only home-grown apparatuses. The principal competition, it seems, was from August Kramer, whose competition Siemens had long acknowledged, and Ferdinand Leonhardt, his erstwhile colleague and earliest collaborator in the field.⁴⁰ The upheavals of 1848 had thus tipped the balance in Werner Siemens' favour.

³⁷ Siemens, *Lebenserinnerungen*, p. 105

³⁸ *ibid.*, pp. 101-27.

³⁹ *ibid.*, p. 100.

⁴⁰ E. Feyerabend, *Der Telegraph von Gauss und Weber im Werden der elektrischen Telegraphie* (Berlin, 1933), p. 208.

Resolution?

It was the geopolitical ramifications of the 1848 revolution which most directly impacted the development of telegraphy. Two months after the convening of the German National Assembly in May 1848, Friedrich-Wilhelm IV ordered the construction of two telegraph lines, linking Berlin to Frankfurt am Main and Cologne.⁴¹ Later in the year, when the Austrian Reichstag was relocated from Vienna following the October uprisings, existing lines were extended to ensure the capital city was connected to the town of Krems, where the deputies were due to meet.⁴² Over the next 18 months, many of the German states were drawn into the construction of extensive lines across the region, principally for the use of government.

The Gordian knot of the production process appeared to have been cut, as experimentation was brought to a rapid conclusion, apparatuses were chosen, and the responsibilities of the respective actors were determined. For a brief moment, the state seemed to control developments, but it was immediately confronted with the need for a new form of necessary cooperation. The networked nature of telegraphy had reared its head, requiring governments to negotiate the terms by which they would manage and finance their undertakings. Having been triggered by the geo-political tremors of the 1848 revolutions, these negotiations were necessarily shaped by the clash of centripetal and centrifugal tendencies taking place across Germany, and focused upon Frankfurt.

The two connections ordered by the Prussian king were to serve both security and strategic purposes. The line to Frankfurt would ensure that the monarch and his government were kept abreast of developments at the heart of the German

⁴¹ H. A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland und die rheinische Industrie : von den Anfängen bis zum Ausbruch des Ersten Weltkrieges* (Wiesbaden, 1983), 153.

⁴² Lobentanz, 'Zur Geschichte', p. 31.

Confederation, where the fate of the nation was being discussed. It was to be fitted with Siemens' telegraph apparatus, and in August, the *Eisenbahn-Zeitung* reported that the lieutenant had been called back from the front line in Schleswig-Holstein to carry out these works.⁴³ The second line would replace Prussia's existing optical telegraph, connecting the state's heartland to its Rhineland territories, and was to be fitted with August Kramer's apparatus.⁴⁴

Constructing a telegraph line from Berlin to Frankfurt required the consent of those states whose territory it would cross. By 5 September 1848, having agreed the relevant terms with the majority of the governments concerned, the Prussian authorities had finally prepared a treaty to be submitted for consideration by the *Senat* which governed the city-state of Frankfurt itself. Presenting the issue to the city's *Constituierende Versammlung* for debate in November, *Bürgermeister* Carl von Heyden described the telegraph as one of 'those continually improving means of accelerated communication, over which the different countries and nations and Europe compete'.⁴⁵ In this respect, he believed, it was similar to those organisations through which one 'had until now sought to outpace the letter post and thereby make a profit in business', and would therefore be used in both 'public' and 'private communication'.⁴⁶ The technology being introduced, Heyden made clear, was to perform social and economic, rather than purely technical functions.

Heyden also highlighted the evident, yet only now relevant dilemma of managing the 'great expansion of telegraph lines, which extend from central points to central points (*Hauptpunkten*), with no regard for territorial borders'. On one hand, the

⁴³ *EBZ*, 21 Aug. 1848.

⁴⁴ Wessel, *Die Entwicklung*, 155-6.

⁴⁵ ISGFM, *Verfassungsgebende Versammlung* Nr. 8, 'Vortrag des Senats an die Constituierende Versammlung', 21 Nov. 1848.

⁴⁶ *ibid.*

lines would inevitably ‘traverse different German states’. On the other hand, he opined, ‘they cannot be installed and administered by different national administrations’. ‘It is therefore entirely appropriate that the Prussian government has undertaken this matter and drawn up treaties with the smaller German states which lie between Berlin and Frankfurt [...]’.⁴⁷

The city’s *Constituierende Versammlung* was not so convinced. The assembly was the product of conflicts between the conservative *Senat* and the efforts of local liberals to introduce constitutional rule in the city-state. In September 1848, popular demonstrations which had degenerated into street fighting had led the National Assembly convening nearby in the Paulskirche to declare a state of siege in the city. Whilst the uprising was put down with the aid of Prussian, Bavarian and Austrian troops, it also resulted in elections to a new constituent assembly.⁴⁸ As the product of both liberal and democratic forces, and of occupation by troops from neighbouring states, the *Constituierende Versammlung* was hostile to the idea of constructing a telegraph line built under the direction of the Prussian authorities.

In this context, the telegraph treaty became a means for the city’s representatives to demonstrate their allegiance to the provisional *Reichscentralgewalt* called into being by the National Assembly in July 1848, at the behest of Heinrich von Gagern. Dr Friedleben, a member of Frankfurt’s *Deutscher Verein*, spoke out against the treaty ‘through which Prussian particularism can easily be advanced to the detriment of the interests of the central authority (*Centralgewalt*)’. ‘[A] new postal life begins with telegraphy’, another member asserted, and so ‘this [was] a matter for the central

⁴⁷ ISGFM, Verfassungsgebende Versammlung Nr. 8, ‘Vortrag des Senats an die Constituierende Versammlung’, 21 Nov. 1848.

⁴⁸ V. Valentin, *Frankfurt am Main und die Revolution von 1848/9* (Stuttgart, 1908), pp. 309-54, 361-4; C.-L. Holtfrerich, *Frankfurt as a Financial Centre: From Medieval Fair to European Banking Centre* (Munich, 1999), pp. 116-25.

authority'. The '*Reichsversammlung*' currently in session had itself recently decided that the *Centralgewalt* was to be empowered to make use of the telegraph, it was noted.⁴⁹ Indeed, the members were also arguably using the new central authority's symbolic status as a means of defending the small city-state against what were seen as Prussia's imperialist ambitions.

In the end, a commission was established to consider the proposed terms, and it reported back on 8 December 1848. It was in favour of signing the treaty with Prussia, but it also hinted at some of its misgivings about the document. From a practical perspective, it was recognised that 'no state which sets its sights upon the interests of public and private communication can exclude itself from the installation of electro-magnetic telegraphs'. The 'given relations' in Germany called for the 'collaboration of a number of states' [underlined in the original], and the five German states participating in the construction of the Berlin-Frankfurt line had 'recognised the necessity of assigning its installation and administration to a single government'.⁵⁰

Prussia had undertaken to pay for the line, and would employ its own personnel, including on Frankfurt's territory. But these would swear an oath to both governments and be 'entirely subject to the authorities and laws of the *Freistaat* of Frankfurt'. The commission also wondered if a future amendment might not allow for locals to be employed as telegraph personnel, something which it considered 'an entirely natural demand'.⁵¹ On one hand, therefore, pragmatism dictated that management of the line should be delegated to Prussia, as long as the treaty guaranteed the city-state's sovereignty.

⁴⁹ ISGFM, Verfassungsgebende Versammlung Nr. 8, 'Auszug Protokolls der verfassungsgebenden Versammlung', 22 Nov. 1848.

⁵⁰ ISGFM, Verfassungsgebende Versammlung Nr. 8, 'Bericht der Commission', 4 Dec. 1848.

⁵¹ *ibid.*

On the other hand, the commission also expressed its desire for a collaborative, rather than delegated enterprise. As it was currently planned, the undertaking had the form of a concession from the *Freistaat Frankfurt* to Prussia, which would then cover its costs. ‘It would have been more just’, the commission added, however, ‘had all the participating governments reached an agreement together (*gemeinschaftlich*) [underlined in original] as to the construction of the telegraph, and had the construction and exploitation taken place at a shared cost and therefore for a shared benefit’.⁵²

Despite the commission’s desires, the need to begin work soon was pressing, and there were obvious benefits in allowing Prussia to bear the financial burden. The negotiations also revealed the persisting tangle of railway and state interests: the governments of Kurhessen and of the Grand Duchy of Hessen had to be drawn into negotiations solely, it seems, because they were participants in the construction of the Main-Weser railway line which the telegraph was to come into contact with. As the Frankfurt commission pointed out, if the treaty contravened their interest in the railway, these governments would not agree to the contract. For the most part, the treaties between the different states were similar, but the agreement between Prussia and the Grand Duchy of Hessen left the decision as to the use of the telegraph by the general public unresolved and open to later negotiation.⁵³

The attempts made by the representatives of Frankfurt to balance inter-state collaboration with the need to designate a managing authority, and the defence of local interests, were intimately connected to the discussions taking place only a few streets away in the National Assembly. To be sure, telegraphy was not the deputies’ primary concern as they sought to establish a framework for a future German nation-state. An

⁵² ISGFM, Verfassungsgebende Versammlung Nr. 8, ‘Bericht der Commission’, 4 Dec. 1848.

⁵³ *ibid.*

analysis of the petitions sent to the parliament, as well as the deliberations of its *volkswirtschaftlicher Ausschuß*, for instance, has identified only one mention of telegraphy by one of the national representatives – a man identified as Vogel, whose details cannot be ascertained.⁵⁴ The position attributed by the assembly to transport and communication has attracted little attention in the literature on the revolutions of 1848/9, and yet its attitude to the post, railways and telegraphy was linked to the structure which it envisaged for the future nation-state.

The potential utility of the telegraph was clearly understood by the deputies meeting in the Paulskirche. It has never been noted that, even before Friedrich Wilhelm ordered that a connection be established between Berlin and Frankfurt, the National Assembly had begun to make use of the telegraph line which had been installed along the Taunus railway, diverting it from its functions as a means of signalling. On 23 May, just as the assembly began to discuss whether or not to request that the government of Mainz revoke the extraordinary measures which it had introduced in light of recent clashes between citizens and soldiers, a telegram informed the deputies that the fortress city had once again been sealed off.⁵⁵ Within a year, an oblique reference in the proceedings of the assembly suggests that certain deputies were even able to send their votes in by means of the telegraph.⁵⁶

Meanwhile, the assembly's *volkswirtschaftlicher Ausschuß* was charged with defining the constitutional arrangements which were to govern a future national telegraph network, and in July 1848 it was initially proposed that these be placed alongside the regulations applying to the railways. Certainly, the technical and logistical

⁵⁴ W. Conze, R. Moldenhauer and W. Zorn (eds.), *Die Protokolle des volkswirtschaftlichen Ausschusses der deutschen Nationalversammlung 1848/49* (Boppard am Rhein, 1992), p. 152.

⁵⁵ F. Wigard (ed.), *Stenographische Berichte über die Verhandlungen der Deutschen Constituierenden Nationalversammlung zu Frankfurt am Main* (10 vols., Frankfurt am Main, 1848-50), i., 59.

⁵⁶ *ibid.*, viii., 5834.

interdependence of the two technologies at the time warranted their association in regulatory terms. It was soon realised, however, that to do so would lay any future telegraph network at the mercy of the tensions in the patchwork of private and state railway administrations currently in operation across Germany.⁵⁷ Just as states sought to assert their authority in the installation of telegraph lines, this initial arrangement threatened once more to constrain the government's sphere of action. Overcoming the administrative quagmire in the railway sector was in fact to take almost a century, only to be achieved with the establishment of the *Reichsbahn* in 1920.⁵⁸

The proposals put forward by the *volkswirtschaftlicher Ausschuß* in the domain of transport and communication were especially forceful in demanding that a centralised, unitary state be established - to the extent that they were often tempered by the subsequent revisions of the *Verfassungsausschuß*.⁵⁹ The committee saw its task as to cater to the 'material' demands expressed in the petitions presented to the parliament, thereby addressing the 'social question' which had been at the heart of the revolutions, but also to contribute to the project of German unification.⁶⁰ It had reached the conviction that 'the greatest possible fusion of the material interests of all of Germany's peoples [*Volksstämme*] through the achievement of a unified system, both internally and externally, would be the most fruitful way to ensure the prosperity of the often vainly vaunted unity of Germany'.⁶¹

The hopes of some of its members for the immediate introduction of a *Reichsbahn* and *Reichspost* were dashed, however, and the proposed authority of the *Reichsgewalt*

⁵⁷ Conze, Moldenhauer and Zorn (eds.), *Protokolle des volkswirtschaftlichen Ausschusses*, p. 89.

⁵⁸ L. Gall and M. Pohl (eds.), *Die Eisenbahn in Deutschland: Von den Anfängen bis zur Gegenwart* (Munich, 1999), pp. 75-81.

⁵⁹ Cf. S. Oelsner, 'Die wirtschaftlichen und sozialpolitischen Verhandlungen des Frankfurter Parlaments', *Preussische Jahrbücher*, 87 (1897), pp. 81-100.

⁶⁰ D. Lindenfeld, *The Practical Imagination: The German Sciences of State in the Nineteenth Century* (Chicago, 1997), p. 159.

⁶¹ Wigard (ed.), *Stenographische Berichte*, v., 3205.

was limited to ‘the right of legislation and supervision’. In the case of the railways, the caveat was added that this was ‘insofar as the defence of the *Reich* and the interests of common transport require it’.⁶² In his seminal account of the revolution, Veit Valentin considered these provisions of the draft constitution to be a relative defeat for the *volkswirtschaftlicher Ausschuß*’ aim of economic unity.⁶³ Yet the terms were in fact sufficiently flexible to accommodate both the existing rights of the parties already administering railways and postal services on the one hand, and the potential future authority of the *Reichsgewalt* in managing state communications networks.

Conditional upon the needs of the ‘defence of the *Reich* and the interests of common transport’, the *Reichsgewalt* was to be allowed to establish railways of its own if and when an individual state refused to do so. The central authority was also to be entitled to use existing railways, in exchange for compensation, and for state purposes.⁶⁴ In postal matters, treaties with foreign countries were only to take place through or with the approval of the central authority, whose right it also was to manage ‘relations between the different postal administrations’. In fact, the *Reichsgewalt* was to be permitted to regulate the different postal routes running through different postal territories ‘in the interest of common transport’, and ultimately to ‘take over the German post for account of the Reich in accordance with an imperial law, conditional upon a proper compensation of the legal beneficiaries’, and ‘insofar as it seems necessary to it [the *Reichsgewalt*]’.⁶⁵ The draft constitution hereby acknowledged the realities of Germany’s divisions, whilst also transferring political notions of the ‘common good’

⁶² E. R. Huber, *Dokumente zur deutschen Verfassungsgeschichte* (3 vols., Stuttgart, 1961-6), i., pp. 304-7.

⁶³ V. Valentin, *Geschichte der deutschen Revolution von 1848-49* (2 vols., Berlin, 1930-1, this edn., 1968), ii., 317-29.

⁶⁴ Huber, *Dokumente zur deutschen Verfassungsgeschichte*, i., 304-7.

⁶⁵ *ibid.*

from the individual states to the supra-regional state which the deputies were seeking to establish.

The final draft of the constitution presented in March 1849 dissociated telegraphy from the railways, and assigned it to article VIII covering the regulation of postal services in the future 'Reich'. The shift reflected the conceptual and technical distinction which had now been established between railway and correspondence telegraphs, and asserted the state's authority over the latter. There was certainly a greater precedent for doing so, given the nationalisation of postal services which had taken place since the early nineteenth century – Karl von Abel, indeed, had considered the telegraph to be analogous to the post.

But the shift was also a statement of the *volkswirtschaftlicher Ausschuß*' understanding of the purposes of communications infrastructure. Its guiding principle, it clearly stated, was that 'all means of communication (*Verkehrsmittel*) must be facilitated and accelerated in every possible way'.⁶⁶ Whilst the state was to control the post, it was to be administered 'solely to the benefit of the general interest'. The committee also believed that the post was to 'perform those services to the German people which it should, and that from a financial institution, it [should] become a mere establishment for the support of communication'.⁶⁷ The constitution thus clearly expressed the desire to put the economic role of communication first, and to shed its functions as a source of revenue for the state.

Telegraphy, moreover did not carry the complex logistical heritage of the railways, or the older postal services, and could thus be subjected to further-reaching regulations. Article VIII §43 of the final text of the constitution presented in 1849

⁶⁶ Wigard (ed.), *Stenographische Berichte*, v., 3217.

⁶⁷ *ibid.*

determined that ‘the *Reichsgewalt* is entitled to install telegraph lines, and to use those already in existence, in exchange for compensation’. Crucially, it also entitled the Reich to ‘come into possession of them by way of expropriation’, giving it far more authority than in other sectors.⁶⁸ During its debates on the matter, the *volkswirtschaftlicher Ausschuß* had pushed for the *Centralgewalt* to be attributed the ‘exclusive’ right of legislation and supervision over telegraph lines, ‘both in the interest of the state and because only in this way could a grand, unified telegraph system for Germany be secured’.⁶⁹ In the final draft, this clause was omitted, though future changes were envisaged insofar as it specified that ‘further decisions on the matter, as well as concerning the use of the telegraph for private communication are subject to imperial legislation’.⁷⁰

Although the constitution of 1849 failed to bring a German nation-state to life, its preparation had laid the groundwork for many developments in the decades which followed. Given how recent the technology was, the discussion of telegraphy in the National Assembly was one of the first explicit attempts to conceptualise and enact its functions and relationship to the state. In particular, the constitution was a formal expression of the primacy of economic interests in the management of communications infrastructure.

Attempts to impose the Reich’s central authority over telegraphy inevitably also impacted upon the individual states’ simultaneous efforts to develop their own networks. For this reason, the aforementioned commission established by the city of Frankfurt to consider its treaty with Prussia followed these developments closely, and determined its stance in accordance with changes being debated in the National

⁶⁸ Huber, *Dokumente zur deutschen Verfassungsgeschichte*, i., 304-7.

⁶⁹ Wigard (ed.), *Stenographische Berichte*, v., 3217.

⁷⁰ Huber, *Dokumente zur deutschen Verfassungsgeschichte*, i., 304-7.

Assembly. The commission was disappointed that the treaty, which had been prepared in September, was made in the name of the *Freie Stadt Frankfurt* rather than the *Freistaat* which it now constituted, though little could now be done to alter this. More significantly, it regretted that the treaty did not take into account the National Assembly's subsequent decisions regarding the role of the new Reich's central authority, which affirmed its right to install and use existing telegraph lines, and foresaw future legislation, as eventually appeared in Article VIII of the draft constitution.⁷¹

The commission demonstrated its strong support for the objectives of the National Assembly. 'At any rate', it wrote, it was 'of the opinion that the German state governments, who have a particular duty to aid in the construction of German unity, may no longer sign any state treaty which does not account in every possible way for the legislation of the Reich, and which does not depend upon it'. This was an opportunity to display the liberal *Constituierende Versammlung*'s desire for the city to participate in the project of national unification. 'The commission fully recognises what a good impression it would create everywhere if the Prussian and present government had both been able to commit themselves in the treaty to follow all orders from the *Reichsgewalt* regarding the telegraph lines in question. But the treaty was [...] decided upon at a time when the relevant legislative powers of the Reich were not yet known'.⁷²

It is questionable to what extent the Prussian government would have agreed with the Frankfurt commission's views. Perhaps pre-empting the northern state's attempts to entrench its position, the report therefore added that: 'although the aforementioned §43 of the German constitution is not yet in force [...] it is already not to be ignored,

⁷¹ ISGFM, Verfassungsgebende Versammlung Nr. 8, 'Bericht der Commission', 4 Dec. 1848.

⁷² *ibid.*

because [...] it can only be to the honour of the governments concerned and of encouragement to Patriots to demonstrate that the separate treaties of individual German states are subject to the higher authority of the *Reichsgewalt*, and to the commandment of unity of the fatherland [...] it must in particular be considered self-evident that the legislative power of the Reich is brought to bear upon the present treaty'. In order to cement this stance, the commission even called for the *Senat* to make known to the German central authority its decisions vis-à-vis this treaty.⁷³

The potential for telegraphy to support the constitution of the Reich had at least some broader resonance. In 1848, a little-known article was penned by Adolph Poppe, son of Johann Moritz Poppe, whose observations on the (optical) telegraph were published in the 1830s and are evoked in chapter 1.⁷⁴ It was one of the very few early texts destined for the general public to deal with the possible shape of a future network, and placed Frankfurt at the very heart of its proposal. The text, published in *Dinglers*, and partly reproduced in *Eisenbahn-Zeitung*, proposed that a '*Reichstelegraphensystem*' would resolve some of the issues caused by Germany's geographical situation which called for 'constant political vigilance', as well as the 'peculiarity of its internal structure'. This situation called for a 'facilitation and acceleration of communication between the central government and the governments of the individual states, as well as a rapid collaboration of the leading authorities'. Such improved communication, meanwhile, would also aid in the acceleration of military operations.⁷⁵

The network, as envisaged by Poppe, would be centred upon the seat of the imperial government, which he foresaw as being located in Frankfurt, and would be

⁷³ ISGFM, Verfassungsgebende Versammlung Nr. 8, 'Bericht der Commission', 4 Dec. 1848.

⁷⁴ A. Poppe, 'Vorschlag zur Organisation eines deutschen Reichs-Telegraphensystems', *DPJ*, 110 (1848), pp. 394-5; cf. Chapter 1, p. 40.

⁷⁵ *ibid.*, p. 394.

Großdeutsch in form. Three lines would emanate from Frankfurt; one leading southwards and eastwards through Stuttgart, Ulm, and Munich to Vienna; one in a north-easterly direction through Leipzig, Berlin, and Stettin to Königsberg; and one northwards through Hanover to Hamburg and Lübeck.⁷⁶

‘From the heart of Germany’, Poppe imagined, ‘the imperial government’s dispatches will reach the seats of government of the individual states within minutes, as well as the furthest war ports and border fortresses; the Reich government will thereby be omnipresent, so to speak, and every political movement, every strike from outside will – through the telegraph as through nerves – instantaneously be transmitted to the central organ of the state body’.⁷⁷ In a particularly ambitious vision, Poppe asserted that all those German towns within the network could receive the full minutes/proceedings of the Frankfurt parliament on the same day.⁷⁸ Poppe’s text, however widespread its diffusion may have been, suggests that the telegraph was beginning to play into the political discussions of the time, particularly the shape of a future German nation-state.

In the end, the dissolution of the National Assembly, and with it the provisional *Centralgewalt*, struck a serious blow to liberal hopes for a centralised nation-state. In a display of (tragic?) irony - or perhaps vindication - whilst the emergence of the National Assembly had triggered Friedrich Wilhelm IV’s decision to construct a telegraph line between Berlin and Frankfurt, it was by means of the very same line that he officially refused the offer of the imperial crown which arguably signed its death warrant, on 28

⁷⁶ Poppe, ‘Vorschlag zur Organisation’, p. 395.

⁷⁷ *ibid.*, p. 394.

⁷⁸ *ibid.*, p. 396.

April 1849.⁷⁹ A few weeks later, a petition sent in to the Assembly called for the Berlin-Frankfurt line to be dismantled as it was serving the needs of ‘rebellious princes’.⁸⁰

The implicit pressure which states had felt to keep up with innovations abroad had now become explicit, as the construction of the first extensive telegraph lines underscored the cooperation required of states in Germany and, eventually, beyond. This phase was triggered by the events of 1848, and as it played out through the prism of events in Frankfurt, it highlighted the geopolitical tensions across Germany. As one newspaper lamented: ‘The difficulties and the circuitousness of negotiations which the current state of German constitutional law necessitates in order for quite a few German dynastic lands and free-state territories to establish a great and useful installation, is exemplified by the fact that the electro-magnetic telegraph line from Berlin to Cologne and Frankfurt a.M. has required no fewer than nine international contracts and one private contract’.⁸¹

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It was the same shifting geopolitical balance which helped break the deadlock in Bavaria. On 23 December 1848, the Austrian ambassador communicated his government’s intention to construct a Trieste-Vienna-Munich-Strasburg connection. The project called for collaboration with the Bavarian government, which was invited to establish a connection between Munich and Vienna, and to commit to extending the line along the Munich-Stuttgart-Karlsruhe railway towards Paris, as well as to Frankfurt.⁸²

⁷⁹ Siemann, *German Revolution*, p. 199.

⁸⁰ Wigard, *Stenographische Berichte*, ix., 6632.

⁸¹ *Königlich privilegierte Berlinische Zeitung*, 10 Jan. 1849, quoted in Siemens, *Lebenserinnerungen*, p. 133.

⁸² BHStA, MH 16863, Oberst von Mayern, ‘Memorandum’, 23 Dec. 1848.

The Austrian government had long since tended to its own internal needs, establishing telegraph lines between Vienna and Prague, Pressburg and Krems, but events had highlighted the need for a much longer-distance connection. The ambassador expressed the hope that Bavaria would ‘not only offer a helping hand in a friendly neighbourly fashion, but also in their reciprocal interests and those of all south-German states’.⁸³ In its very terminology, therefore, the proposal immediately brought the political layout of the region into play.

At stake were both Austria’s relationship with the *Reichscentralgewalt* in Frankfurt, and the need to strengthen southern German relations. By this time, indeed, the Austrian Minister-President Prince Schwarzenberg and his new conservative government had declared their opposition to the National Assembly’s proposals for a ‘*Großdeutsch*’ solution to the national question. As a result, the Assembly’s attention had turned to Prussia as a potential leader in the unification process, and it was therefore all the more important that Austria obtain support for the loose German confederation which it propounded.⁸⁴

The memorandum on the issue, prepared by Oberst von Mayern, emphasised the geopolitical and strategic interests at hand. It raised the fact that ‘today, now that steam-powered means of communication have taken away from governments their precedence in the knowledge of distant events, it can only be won back using telegraphic connections [...] Prussia has already recognised this’.⁸⁵ The statement may have referred primarily to Prussia’s pre-existing optical telegraph line connecting Berlin and Cologne, but its significance was clearly enhanced by the ongoing construction of a new line to Frankfurt. Whilst highlighting the well-established temporal advantage which

⁸³ BHStA, MH 16863, Oberst von Mayern, ‘Memorandum’, 23 Dec. 1848.

⁸⁴ Siemann, *German Revolution*, pp. 188-199.

⁸⁵ BHStA, MH 16863, Oberst von Mayern, ‘Memorandum’, 23 Dec. 1848.

telegraphy could confer upon a government, the memorandum also hinted at the implicit competition with Prussia.

Mayern also highlighted the internal security concerns in Bavaria which the installation would help to improve. He suggested, for instance, that it would secure closer relations with the Pfalz, much as had occurred between Prussia and its Rhineland territories. Turning to a renowned historical precedent, he proceeded to evoke the advantages which had fallen to Napoleon from his possession of (optical) telegraphs in the early nineteenth century, and the natural 'geographical and ethnographical layout of the theatre of war towards the West'. In this regard, Oberst von Mayern emphasised that the telegraph could reduce the time needed to inform Vienna that an enemy army had crossed the Rhine from four days to a matter of hours.⁸⁶

The initiative revitalised the Bavarian administration's interest in the technology, and by January 1849 inquiries confirmed that Baden and Württemberg, whose territories would have to be crossed by the proposed line, were also on board with this south-German telegraph project.⁸⁷ Meanwhile, Foreign Minister Otto von Bray-Steinburg wrote to the minister of war to emphasise the strategic interests involved, particularly regarding the kingdom's defence against the West, informing him that the matter had also already been raised in Frankfurt.⁸⁸

Like the Prussian line, indeed, the initiative spotlighted the ambiguities of the period during which the role of the National Assembly in Frankfurt and the future of the German Confederation remained unclear. Austria, Bavaria, Baden and Württemberg were invited to collaborate in different capacities: on their own account and in their own

⁸⁶ BHStA, MH 16863, Oberst von Mayern, 'Memorandum', 23 Dec. 1848.

⁸⁷ BHStA, MH 16863, Brenner to Bray-Steinburg, 17 Jan. 1849.

⁸⁸ BHStA, MH 16863, Bray to Le Suire, 31 Jan. 1849.

interest, but also as a 'South-German' grouping opposed to Prussian domination, as well as in consultation with the provisional *Centralgewalt* established Frankfurt, whose precise claims to authority were still vague and contested.

Conflicts between the states were inevitable, and Bray-Steinburg wrote to the new minister of trade, under whose authority telegraphy now fell, pointing out the issues with the Austrian proposition. In a similar situation to that in Frankfurt, Austria intended to take charge of construction on Bavarian territory, but unlike the authorities in the city-state, Bray-Steinburg was in a position to categorically refuse such an arrangement. Once again, the *Centralgewalt* served as a buffer between the states, and Bray insisted that the matter should be discussed by the Bavarian representative in Frankfurt, and decided in conjunction with the *Reichsministerium*. It was uncertain, he explained, whether the latter would consider the installation a '*Reichsanstalt*', and to what extent it might encourage Baden and Württemberg to work on the project.⁸⁹

From January until the summer of 1849, the Bavarian state engaged in discussions with neighbouring states in order to establish the logistics, finance and legal status of its future telegraph lines. Additionally, earlier plans for a north-south line from Kaufbeuren to Hof line were revived, as the objective of a full state-wide network re-appeared on the horizon.⁹⁰ Initially, it was expected that the *Reichsministerium* might mediate the negotiations between Bavaria, Baden and Württemberg.⁹¹ By the end of March, however, the new Reich constitution had been published, Austria had effectively been excluded from the process of unification, and the imperial crown had been offered to

⁸⁹ BHStA, MH 16863, Bray to HM, 22 Feb. 1849.

⁹⁰ BHStA, MH 16863, Bray, Memorandum, 30 Mar. 1849.

⁹¹ BHStA, MH 16863, 30th Mar. 1849.

Friedrich Wilhelm IV in Prussia.⁹² Now, Bray-Steinburg believed that direct discussions should begin with Austria.⁹³

The process is all the more significant insofar as Bavaria famously rejected the constitution of 28 March 1849, along with Austria, Württemberg, Saxony and Hanover. Despite the government's opposition, throughout the *Centralgewalt*'s existence between 1848 and 1849, its potential authority was taken into consideration. Whether this was out of support for the project of unification or – most probably – for the utility of the central authority as a safeguard against the claims of both Prussia and Austria, these developments lend credence to the argument that, contrary to widespread perceptions, the authority being constituted in Frankfurt did indeed enjoy a degree of support from the German governments.⁹⁴

After the National Assembly disbanded in May 1849 and the prospect of a German Reich centred in Frankfurt faded, the new Foreign Minister Ludwig von der Pfordten decided that contracts should be established with the individual states which would be concerned by the projected lines, and that inquiries should be made as to the arrangements which had been agreed between Prussia and Saxony, so as to adopt a similar model.⁹⁵ The system of bi-lateral agreements had prevailed.

By the spring and summer of 1849, the interdependence of the states involved in establishing the line had increased the pressure upon Bavaria to initiate construction. Already in March, Bray-Steinburg had asserted that '[u]nder the present circumstances, and given the widespread usage of telegraphs now in different parts of Germany, there cannot be the least doubt as to the importance and decided necessity of a rapid

⁹² Siemann, *German Revolution*, pp. 188-99.

⁹³ BHStA, MH 16863, Bray, Memorandum, 30 Mar. 1849.

⁹⁴ Siemann, *German Revolution*, p. 130.

⁹⁵ BHStA, MH 16802, Pfordten to Bever, 9 Jul. 1849.

introduction of telegraph lines in different directions in Bavaria, and we will have to proceed to negotiate its most important undertaking'.⁹⁶

Around the same time, the *Akademie der Wissenschaften* urged the government not to wait for a decision from the military authorities, as the social, commercial and military incentives for the line were clear enough. The *Akademie's* report even briefly looked ahead to consider the potential shape of a future network, proposing that Augsburg be considered its central point, as the junction between north-south and east-west traffic flows. There were no political reasons for a line to be established to Frankfurt, it claimed, but economic motivations might still support the idea. Above all, however, the *Akademie* urged the government to abandon any further experimentation and to adopt a system which had proved successful elsewhere.⁹⁷ The chief engineer of the *Eisenbahnbau-Kommission* himself asserted that he was ready to begin work upon the Munich-Vienna line as soon as Carl Steinheil's patent expired at the end of August.⁹⁸

` In Prussia, as we have seen, the events of March 1848 had served to streamline the technical decision-making process and to sway the state administration's decision in Werner Siemens' favour. Similarly, although progress in Bavaria was ultimately blocked by the government's commitment to Steinheil's *Privilegium*, external pressures had accelerated the preparatory process, initiating negotiations with neighbouring states, the planning of individual lines, and even the abandonment of Steinheil's apparatus in a search for alternatives.

⁹⁶ BHStA MH 16863, Bray, Memorandum, 30 Mar. 1849.

⁹⁷ BHStA, MH 16863, 'Bericht, Vorstand der Akademie der Wissenschaften', 15 Mar 1849.

⁹⁸ BHStA MH 16863, 'Bericht der Eisenbahnbau-Kommission', 27 Mar. 1849.

For the purposes of expediency, the Austrian administration had in fact initially proposed that an optical telegraph be employed on the Munich-Vienna line, using a model developed by a certain Christoph Rad. Both the Bavarian *Polytechnischer Verein* and the *Akademie der Wissenschaften* were asked to evaluate the proposal, and although they struggled to access any published material on the invention, both concluded that adopting an optical system would be to ‘regress’ (*zurückgehen*).⁹⁹ Steinheil himself was involved in the evaluation of the available options, and whilst he also preferred adopting an electrical system, he recognised the advantages which an optical telegraph might offer when its counterpart was interrupted - in times of war, for instance. ‘It would certainly be safer to leave both mechanisms alongside each other; but this could be too expensive to set up’, he concluded.¹⁰⁰ Shortly thereafter, the Austrian government itself abandoned the ‘*Rad’sche Telegraph*’, effectively signing the optical telegraph’s death warrant as a means of ordinary correspondence in the south of Germany.¹⁰¹

By now, Steinheil was forced to acknowledge his own apparatus’ shortcomings, but he still used the opportunity to emphasise the advantages of the auditory component which he had included in his mechanism. The system enabled the transmitted symbols to be heard through a system of bells. ‘[Its] advantages are so evident’, he wrote, ‘that even the great difficulties with which the galvanic telegraph is currently struggling would not be in a position to prevent its rapid dissemination’.¹⁰² Even in the thick of practical decision-making, the academic set his sights upon the much more distant horizon of telephonic communication.

⁹⁹ BHStA, MH 16863, Bever to Polytechnischer Verein, 13 Feb. 1849; BHStA, MH 16863, Polytechnischer Verein to HM, 14 Mar. 1849.

¹⁰⁰ BHStA, MH 16863, ‘Auszug, Protokoll der dritten Sitzung der math-phys. Klasse’, 10 Mar. 1849.

¹⁰¹ BHStA, MH 16863, Bray, Memorandum, 30 Mar. 1849.

¹⁰² BHStA, MH 16863, ‘Auszug, Protokoll der dritten Sitzung der math-phys. Klasse’, 10 Mar. 1849.

Whilst Steinheil's telegraph initially remained on the cards, the need for alternatives was pressing, and the negotiating parties were becoming restless. The *Eisenbahnbau-Kommission* had already inquired into the system developed by a manufacturer in Saxony, Emil Stöhrer, and under the circumstances, Bray-Steinburg believed that, as 'a loss of time in the field of our own further experiments could be involved, it seems necessary to get to know the electro-magnetic telegraph installations in the other German states [...]'.¹⁰³ The American, Robinson, who had helped introduce Morse's apparatus to the German market, had offered his services as a consultant, but Carl Steinheil himself had offered to tour Germany on the commission's behalf. The minister recommended taking up the latter's offer, in the hope that to do so would 'simultaneously help set aside a forthcoming disagreement in relation to Steinheil's *Privilegium*', and thus help resolve the situation.¹⁰⁴

Preparations were continued, but the Bavarian envoy in Austria noted his counterparts' impatience, and their shock at the slow pace of progress.¹⁰⁵ Both the *Polytechnischer Verein* and the *Akademie der Wissenschaften* now insisted that telegraph lines would be needed both along railways and outside them, an issue which Prussia and Austria had confronted years earlier.¹⁰⁶ This realisation in turn highlighted the need for separate wires and apparatuses along the same lines – simple pointer-telegraphs for the railway service, and printing telegraphs for government service.¹⁰⁷ Other rapid decisions were made so as to speed up the project, as preparations began to outpace the production process: when the Munich-Hof line was begun ahead of

¹⁰³ BHStA, MH 16863, 'Bericht der Eisenbahnbau-Kommission', 12 May 1848; BHStA, Verkehrsarchiv 30056, Bericht der Eisenbahnbau-Kommission', 1 Feb. 1849; BHStA VA; BHStA, MH 16863, Bray, 'Antrag an den König', 28 Mar. 1849.

¹⁰⁴ BHStA, MH 16863, Bray, 'Antrag an den König', 28 Mar. 1849.

¹⁰⁵ BHStA, MH 16863, 'Bericht des Civil-Ingenieurs F. Kreuter', 24 Apr. 1849.

¹⁰⁶ BHStA, MH 16863, Bray, 'Antrag an den König', 28 Mar. 1849.

¹⁰⁷ BHStA, MH 16863, 'Bericht der Generalverwaltung der Posten und Eisenbahnen', 7 Apr. 1849.

schedule in May, for instance, iron rather than copper wires were chosen, and certain wires were to be hung above ground rather than laid underground ‘in consideration of the fact that the line must be established as quickly as possible’.¹⁰⁸

On 30 August 1849, Carl Steinheil’s *Privilegium* finally expired, and work began on the construction of the telegraph line between Munich and Salzburg. By then, the geopolitical situation had been altered, and Württemberg had backed out of the project to extend the line to Strasbourg. Not only had the turbulence of the period subsided, no doubt removing both socio-economic pressure and encouragement from the *Reichsministerium*, but political events had left the state with too little money to devote to the telegraph line.¹⁰⁹ In order to circumvent Württemberg, another line was proposed which would cross the city of Frankfurt on its way to Strasbourg and Paris, and which the foreign minister, Ludwig von der Pfordten, believed would be one of the most important, ‘particularly if Frankfurt were to remain the centre of the Confederation’s affairs’.¹¹⁰ This outcome was now uncertain, however.

Establishing the Munich-Salzburg connection had been the government’s priority, and only once the pressure diminished in late October could proper consideration be given to the broader network of which it was to be a part. ‘The next and most pressing task’, Pfordten explained, ‘now consists of deciding here in Bavaria on the direction of the principal lines, their priority, the system to be adopted, as well as the form of administration, etc., and to make the necessary means available. In both respects, the preparatory work will be the task of the relevant competent organisation, but the

¹⁰⁸ BHStA, MH 16802, ‘Sitzung im MA’, 10 May 1849; BHStA MH 16863, 31 May 1849.

¹⁰⁹ BHStA, MH 16802, Pfordten to MA, 5 Aug. 1849.

¹¹⁰ BHStA, MH 16799, Pfordten to HM, 25 Sep. 1849.

decision will have to be submitted to joint ministerial consideration, in which the royal war ministry should be considered a participant'.¹¹¹

The Case of Bremen

Domestic demand, rather than strategic or political necessity, had been at the heart of Bremen's telegraph network from the outset. Indeed, the city's connection to Bremerhaven, which had opened on 1 January 1847, had been both financed and administered by the private Telegraphen-Verein on behalf of the city's business community. After 1849, however, here too the state assumed a managerial role in the network's development, as the need to establish treaties with its neighbours became apparent. Indeed, the *Hansestadt* had been drawn closer to other German states over the course of the revolutions. It had itself been shaken by popular revolts, and a new governmental structure threatened the authority of the ruling *Senat*. One of its leading figures, Senator Arnold Duckwitz, meanwhile, had led the provisional *Reichshandelsministerium* in Frankfurt, and encouraged the formation of a German navy.¹¹² As sections of the city-state's elite turned their eyes away from the coast and towards the rest of Germany, the *Senat* and *Handelskammer* increasingly struggled to align their domestic and foreign interests.

As we have seen, in 1847 demand for a telegraph line between Hamburg and Cuxhaven had generated further proposals for the connection to be extended to Bremen. In February 1848, the company running matters in Hamburg had obtained a concession from the Hanoverian government for the construction of the Hamburg-Cuxhaven

¹¹¹ BHStA, MH 16799, Pfordten to HM, 25 Sep. 1849.

¹¹² H. Schwarzwälder, *Geschichte der Freien Hansestadt Bremen* (4 vols., Bremen, 1975-85), ii., 181-96.

portion.¹¹³ A year later, as the extension of the line to Bremen was envisaged, the director of the Bremer Telegraphen-Verein asked the local *Senat* for a concession to establish the connection.¹¹⁴ Traditions of private enterprise were clearly still strong on the north-western coast, but the need to negotiate an acceptable treaty for the installation of wires along the territory of neighbouring Hanover and Prussia called for the *Senat* to intervene.

By November 1849, with states throughout Germany projecting lines in multiple directions, Bremen too was drawn into the diplomatic game. Freshly returned from Frankfurt, Arnold Duckwitz, addressed the *Senat* on the issue of establishing telegraph connections with Prussia and Hanover. The Prussians, in particular, had approached the government in the hope of establishing a connection between their existing telegraph lines and their post office within Bremen. As Duckwitz explained, this posed a dilemma for Bremen.¹¹⁵

On one hand, he emphasised ‘the great importance of such a connection for communication’. On the other hand, he evoked its ‘implication for the independent position of the state in relation to the telegraph institute’. In this regard, he believed ‘it would be very questionable to grant the Prussian post office, or any other foreign government, similar rights as those they possess contractually in postal matters in the sphere of telegraphic correspondence’. Duckwitz recognised the geopolitical fact that ‘Bremen is also unable to enter into possession of this new important means of communication without the cooperation of foreign governments, namely Prussia and Hanover’.¹¹⁶ As the erection of the Berlin-Frankfurt line had revealed, collaboration

¹¹³ *EBZ*, 28 Feb. 1848.

¹¹⁴ *StAB*, 2-R.15.b.1, Direktoren des Bremer Telegraphen-Vereins to *Senat*, 23 Jun. 1849.

¹¹⁵ *StAB*, 2-R.15.b.3, ‘Extract aus dem Senatsprotocolle’, 28th Nov 1849.

¹¹⁶ *ibid.*

between states, and particularly small states, was essential to their obtaining the technology, but Duckwitz was also concerned to defend the ‘independent position’ of the Telegraphen-Verein.

For the *Senat* to assume responsibility for the telegraph network would carry other potential benefits, however. Duckwitz understood that the importance of telegraphic communication for Bremen’s trade would increase once it was used ‘not only for exceptional notifications, but on a regular basis, [for] reports and business transactions’. At that point, as had been the case with the postal service, ‘this type of correspondence might be associated with significant financial and state interest’. In the future, therefore, he believed that ‘certain questions will be addressed, which will require the constant attention of the *Senat*, and whose neglect in times past have led to the current situation of telegraphy in Bremen’.¹¹⁷

Allowing Prussia to dominate the telegraph network at an early stage, Duckwitz argued, would enable it to reap the financial and strategic benefits which would later derive from the institute. ‘Prussia is therefore handling matters very cleverly’, he stated, by engaging in negotiations ‘at a time in which we cannot survey the consequences and importance of postal-telegraphic correspondence’. In addition, Duckwitz believed that the foreign government’s intentions might well be to administer and finance the lines themselves, and to reserve it for Prussian use. This was the case, he erroneously believed, on the Berlin-Frankfurt line, and Duckwitz therefore advised collecting ‘more details on the intentions of Prussia, as well as the views of Hanover’ so as ‘not already to commit ourselves to obligations’.¹¹⁸ The *Senat*, Duckwitz made clear, must intervene

¹¹⁷ StAB, 2-R.15.b.3, ‘Extract aus dem Senatsprotocolle’, 28th Nov 1849.

¹¹⁸ *ibid.*

in the establishment of new telegraph lines to defend the strategic interests of the city-state as a whole.

Negotiations with Prussia and Hanover had not only highlighted the strategic interests which the *Senat* was now called to defend, but also the importance of establishing connections to German markets, in addition to Bremen's existing overseas interests. Whilst the Prussian proposal was under consideration, another telegraph line was also due to be installed along the railway leading southwards from Bremen towards Wunstorf and Hanover, for signalling purposes. The connection would provide easier access to these markets, and it was hoped that the telegraph might also be used to transmit ordinary correspondence.

In November 1849, therefore, Hermann Heye wrote to the *Senat* on behalf of the *Handelskammer*, asking that it establish contact with the Hanoverian government regarding the proposed Bremen-Wunstorf line. Heye explained that Bremen should not be excluded from such a 'significant tool of trade' which was being constructed 'between almost all places of significance in Germany', particularly given 'the recent permission granted by the respective governments for its use in the transmission of private correspondence'.¹¹⁹

There was an alternative to the direct Bremen-Wunstorf line, but it would threaten the city's position on the German market. Indeed, Bremen would also benefit from the Bremerhaven-Cuxhaven-Hamburg connection which was under consideration by the private enterprise evoked earlier. In conjunction with the Hamburg-Wunstorf line, Bremen could then communicate with Hanover through Bremerhaven, but this convoluted connection would place Bremen at a disadvantage, as 'along this route, all

¹¹⁹ StAB, 2-R.15.b.3, Hermann Heye to Senat, 29th Nov. 1849.

news from middle and southern Germany would always only reach us through Hamburg, and would therefore be delayed'.¹²⁰ Constructing a shorter Bremen-Wunstorf line would also simplify matters, as it required negotiating with only one foreign government.

The necessity of government intervention in order to effectively defend these commercial interests through a process of inter-state negotiation was therefore well recognised. Rather than turning to private initiative as local merchants had done in the past, Hermann Heye stated that 'the now almost universally followed principle, that telegraphs are more efficiently constructed by the state, under whose supervision and influence they are left, should also apply in this instance'.¹²¹

By December, the Hanoverian government had agreed to the laying of a second wire along the Bremen-Wunstorf railway.¹²² Regarding further connections, however, such as those to Prussia, Bremen was also dependent upon Hanover's attitude to the proposals put forward. The latter had already made concessions for Prussia to build a line to Cologne across its territory, and was reluctant to accept further encroachment into its jurisdiction.¹²³ Pushing for more action to be taken, the Bremen *Handelskammer* later called on the *Senat* to undertake direct negotiations with Prussia instead.¹²⁴

The interests of the *Senat* and the *Handelskammer* representing the merchant community had traditionally been aligned, ensuring that strategic and economic concerns went hand in hand. As the telegraph presented new opportunities to connect to the German market, however, tensions began to emerge. So much so that, in 1850, when the *Senat's* concern to defend Bremen's geopolitical stance towards its neighbours

¹²⁰ StAB, 2-R.15.b.3, Hermann Heye to Senat, 29th Nov. 1849.

¹²¹ *ibid.*

¹²² StAB, 2-R.15.b.3, 'Extract aus dem Senatsprotocolle', 7 Dec. 1849.

¹²³ StAB, 2-R.15.b.3, Duckwitz to Senat, 1 Dec. 1849.

¹²⁴ StAB, 2-R.15.b.3, 'Extract aus dem Senatsprotocolle', 1 May 1850.

threatened to sabotage the construction of further telegraph lines, the *Handelskammer* wrote to emphasise their commercial value. Whilst conceding that there were political and diplomatic issues at hand, it ‘placed great value on the positive result of these efforts, in that it is convinced that considerations of less significance should be rebuffed (*zurückzuweisen*) in an enterprise whose use is so important, indeed indispensable for our commercial interests’.¹²⁵

Negotiating Bremen’s accession to the emerging telegraph network had begun to reveal divisions within the city’s political and commercial elite. Their alliance had been based upon a firm strategic independence from other German states, and upon their ties to overseas markets, particularly in the United States. Communications networks which connected the city-state to German markets required a more direct engagement with neighbouring states, however, jeopardising this strategic isolation. The telegraph revealed divisions between the city’s commercial and political focal points, and foreshadowed the disintegration of its ‘cosmopolitan community’ as it was tied into emerging German industries and markets.¹²⁶

Conclusion

As the telegraph came into operation, the internal pressures of the development process which appeared to have been resolved resurfaced in a new form. By early 1849, for instance, persistent complaints from the railway companies in Prussia led the government to reconsider the terms of the concessions which it had granted them. As Wolfgang Löser argued, the original concessions were redrafted as contractual

¹²⁵ StAB, 2-R.15.b.3, Hermann Heye, Namens der HK, to Senat, 30 Apr. 1850.

¹²⁶ L. Maischak, *German Merchants in the Atlantic* (Cambridge, 2013), pp. 197-220.

arrangements – symbols of a more liberal economic policy, and a sign of the state's accommodation with the forces of bourgeois capitalism after the events of 1847/9.¹²⁷ In Hessen too, where the concessions proposed by the state had led to the abandonment of trials along the *Friedrich Wilhelm Nordbahn*, 'the political events of recent times encouraged the management [of the railway company] to sue for damages'.¹²⁸ These were a reminder that the process of technological production and industrialisation was not over, and would continue to necessitate cooperation between its principal actors.

At the same time, public consumers of the service emerged, hinting at a new internal force with which the state administration would have to reckon. When Prussia's first telegraphic connection between Berlin and Frankfurt was opened in February 1849, for instance, it was intended exclusively for government use, but pressure had mounted for the service to be made available to the public. In June, it was decided that the line would be progressively made accessible to individuals for the purposes of private correspondence, and by October, the Frankfurt *Handelskammer* initiated negotiations to obtain the daily run of stock prices by telegraph.¹²⁹ In November, Bernhard Wolff established his *Telegraphisches Büro* in Berlin, delivering telegraphic news to the press, and based on existing demand, the *Eisenbahn-Zeitung* estimated that private uptake in Prussia would soon cover the costs of the network's construction.¹³⁰

In many ways, the events of 1848/9 had accelerated a process already underway and determined the shape of things to come. They stimulated the construction of extensive lines for the purposes of government communication and, in the process, forced the resolution of many undecided questions in the development of the

¹²⁷ Löser, 'Die Rolle des preußischen Staates', p. 205.

¹²⁸ *EBZ*, 11 Sep. 1848.

¹²⁹ *EBZ*, 9 Jul. 1849; *ibid.*, 2 Oct. 1849.

¹³⁰ *EBZ*, 17 Nov. 1849.

technology. As a result, however, they also required states to assume responsibility for the management of networks, as a process inter-state negotiation was unleashed which was necessary to the construction of larger networks. For a while, these negotiations revolved around the decisions being made in the National Assembly in Frankfurt. For as long as the 'Reich' seemed to be accruing credibility, a central German authority appeared an effective means of establishing large-scale telegraph networks. Once the *Centralgewalt* faded away in 1849, a system of multi-lateral agreements prevailed, foreshadowing the future establishment of the *Deutsch-Österreichischer Telegraphen-Verein*.

But the consideration given to communications infrastructure by the National Assembly, and the struggle of the *volkswirtschaftlicher Ausschuß* to establish a unified German economy under the authority of a Reich ministry, were a sign of things to come. From now on, the role and function of telegraphy were to become closely associated with the aim of promoting economic growth, rather than increasing state revenue. Across Germany, therefore, whilst the state had established itself in a managerial position, and had carved out its authority over telegraphy as a means of communication, it became the subject of particular expectations from the technology's consumers. As the technology continued to evolve, new actors came on stage, and as new degrees of local and regional connections were formed, the state found itself at the mercy of both internal and external pressures - a single cog in a complicated mechanism of technological development, implementation and diffusion.

Part II: The Impact of Telegraphy, 1850-1880

Chapter Four: Inclusion and Exclusion

‘Right from the cradle, our efforts are directed towards enabling us to communicate, to receive from others, to impart to others; these efforts, both great and small, presuppose a mutual exchange of the means of satisfying human needs. Like an instinct, it dominates Man’s actions [...] Exchange is the bearer of all wellbeing, the vehicle of all progress’.¹ With these words, in 1857 Karl Knies described what he believed was the elemental force behind the development of new means of transport and communication in his time. Praising the advances which had brought ‘new species of goods, entire new classes of people’ into movement, he looked to the future: ‘And still we must say: the facilitation of communication is for our time not only a monument to what has been achieved, but also a magnet for our endeavours’.²

As Knies had understood, the efforts which governments had undertaken to construct transport and communications networks had unleashed a self-perpetuating cycle of supply and demand. Referring to the dissemination of news in particular, he explained that it ‘not only satisfies a felt need [...] but also evokes it in many places.’³ To provide a service in one location, therefore, was to create a desire for it elsewhere, and as he astutely foresaw, ‘whosoever wants the telegraph, so as to make use of this means of communication, must also want every additional wire, just as soon as traffic requires it’.⁴

¹ K. Knies, *Der Telegraph als Verkehrsmittel* (Tübingen, 1857), p. 1.

² *ibid.*, p. 2.

³ *ibid.*, p. 64.

⁴ *ibid.*, p. 210.

The same could be said of the movement of ‘association’ through which states had begun to establish extensive networks across Europe. ‘Telegraph unions’, he wrote, ‘have the peculiar quality that, in pursuing their objectives, they cannot stop at extending a friendly neighbourly hand [...] but must bring about a true commonality in the management and advancement of everything which concerns two countries simultaneously’.⁵ In this domain too, he explained, expansion was inevitable: ‘As the telegraph also necessitates agreements integrating the greatest of distances, even the system of associations between groups of states cannot be the ultimate objective. The telegraph unions within our continent will become a telegraph union of all states on our continent. The seeds have not only been sown, their shoots can be seen above the ground’.⁶

Knies’ assessment of the telegraph’s triumphant expansion highlighted both the external and internal pressures to which German governments had subjected themselves in 1848/9, when they assumed responsibility for its development. During the 1850s, telegraph networks were at the heart of the intensified public and private economic activity which accompanied the era of political ‘reaction’.⁷ As Abigail Green has shown, policies of cultural and infrastructural integration were introduced or stepped up in this period, as a means of further legitimising the dynasties and states which had risen from the ashes of the Holy Roman Empire. Facing the threat of political nationalism, governments supported the construction of telegraph, railway and postal networks in the

⁵ Knies, *Der Telegraph*, p. 205.

⁶ *ibid.*

⁷ On this characterisation of the 1850s, see T. S. Hamerow, *Restoration, Revolution, Reaction: Economics and Politics in Germany, 1815-1871* (Princeton, NJ, 1958), pp. 219-37.

public interest, as a means of ensuring their subjects' loyalty whilst asserting their own allegiance to a greater German identity.⁸

In Bavaria, the accession to the throne of Maximilian II in 1848 had accentuated this new direction in an otherwise long-standing domestic policy of state integration. In the first decades of the nineteenth century, King Maximilian I and his chief minister, Maximilian von Montgelas, had introduced constitutional reforms and a centralised bureaucratic structure in an effort to integrate the territories, cities and bishoprics transferred to Bavaria in 1806 and 1816.⁹ From 1825 until his abdication in 1848, Ludwig I and his conservative ministers had then sought to strengthen allegiance to the Wittelsbach dynasty by enhancing the role of the church and education in society.¹⁰

During the 1850s, Maximilian II developed his own policy on the basis of advice he sought from academics such as Leopold von Ranke, and Wilhelm Heinrich Riehl. In particular, the king asked his advisors for their opinion on the 'tendencies of the times' and on the attitude he should adopt towards socio-economic change.¹¹ Despite his characteristically monarchical personal dislike for the social impact of industrialisation and capitalism, Maximilian recognised the need to accompany and guide these forces in a direction which avoided dramatic upheavals.¹² State management of the railways was part of a policy designed to do so, and as an emphasis was placed on the

⁸ A. Green, *Fatherlands: State-Building and Nationhood in Nineteenth-Century Germany* (Cambridge, 2001), esp. pp. 223-66.

⁹ E. Weis, 'Die Begründung des modernen bayerischen Staates unter König Max I. (1799-1825)', in M. Spindler (ed.), *Handbuch der Bayerischen Geschichte* (4 vols., Munich, 1967-75), iv./1, 38-58; W. Blessing, 'Staatsintegration als soziale Integration: zur Entstehung einer Bayerischen Gesellschaft im frühen 19. Jahrhundert', *Zeitschrift Für Bayerische Landesgeschichte*, 41 (1978), pp. 633-700.

¹⁰ N. Mayr, 'Particularism in Bavaria: State Policy and Public Sentiment, 1806-1906' (University of North Carolina Ph.D. Thesis, 1988).

¹¹ M. Hanisch, *Für Fürst und Vaterland: Legitimitätsstiftung in Bayern zwischen Revolution 1848 und deutscher Einheit* (Munich, 1991), pp. 94-148.

¹² Hanisch, *Fürst und Vaterland*, 108.

complementarity of different means of communication, telegraphy was directly concerned.¹³

Adopting this directorial stance, however, exposed the government to the internal and external pressures described by Knies. Unlike the railways, whose construction required considerable investment and time, telegraph lines were built relatively quickly, and the rapidly emerging European network necessitated immediate coordination between governments. A vicious – or perhaps virtuous - cycle of international development had been engaged, as one administration called upon the next to cooperate in the provision of reliable, uninterrupted communication.

At the same time, the implementation of telegraph networks introduced a new force into the domestic social and economic relations which the states were seeking to manage. As this chapter will argue, whilst the wires laid by governments were aimed at connecting the state's administrative, strategic and economic centres, during the 1850s they primarily came to serve the needs of business communities built upon the exchange of information. Telegraph lines became the material channels of communication underpinning the European bourgeoisie's thickening administrative, professional and financial 'networks of means'.¹⁴

In particular, the telegraph served to connect and enhance the status of trade and finance centres across Germany, supported by the press. It strengthened networks of private banking, whilst also fuelling the emergence of the securities market which later

¹³ *Rückblick auf das erste Jahrhundert der Kgl. Bay. Staatspost (1.3.1808 bis 31.12.1908)*, ed. Kgl. Bay. Staatsministerium für Verkehrsangelegenheiten (Munich, 1911), p. 9.

¹⁴ J. Seigel, *Modernity and Bourgeois Life: Society, Politics and Culture in England, France, and Germany since 1750* (Cambridge, 2012), pp. 1-37.

came to dominate investment in industry.¹⁵ Within a few years, bankers and merchants were joined by manufacturers, industrialists and even agricultural producers whose fortunes oscillated with the increasingly frequent fluctuations in commodity prices caused by rapid communication. The telegraph was thus at the heart of the nexus of finance, trade, and communication which combined with an industrial and agricultural upswing to fuel Germany's industrial 'take-off'.¹⁶ As the main beneficiaries of both local and transnational communication, business circles placed the most pressure upon the state to improve telegraphic infrastructure, and their needs came to feature prominently in the government's changing economic policy.

At every stage of its development, from its planning, to its construction and utilisation, the telegraph network fed the dual pressures placed upon the state by establishing a binary distinction between those included and those excluded from its reach. From the governments seeking both to integrate a European network and manage their own societies, to the municipalities neglected when their neighbours obtained a connection to the service, and the businessmen who understood that sections of the economy now pulsed at a higher rate, all experienced the hopes of accessing the telegraph and the anxieties at being deprived of it. Their demands fuelled the network's expansion, and influenced the visions of communication held by members of government and parliament.

Those included in the telegraph network were set apart from their fellow citizens and subjects by their ability to communicate within a shared, measured, and theoretically homogenous framework of time. As different sections of society were

¹⁵ R. Michie, *The Global Securities Market: A History* (Oxford, 2006), pp. 83-118; cf. also, Y. Cassis, *Capitals of Capital: The Rise and Fall of International Financial Centres, 1750-2009*, transl. J. Collier (Cambridge, 2010), pp. 41-73.

¹⁶ H.-U. Wehler, *Deutsche Gesellschaftsgeschichte* (5 vols., Munich, 1987-2008), iii., 66-97.

given this temporal advantage over others, a process of ‘de-synchronisation’ set in. Even within the network, however, technical constraints soon limited the capacity for the telegraph to serve all users equally. These limitations were as influential as the technology’s much-vaunted benefits in shaping the habits of communication which Karl Knies sought to analyse, and which fed back into the changing concept of *Verkehr*.

Planning the Network: External and Internal Pressures

After years of experimentation, and some months after the haphazard construction of a number of lines had begun in the autumn of 1849, the Bavarian government undertook to plan the future layout of its telegraph network. By this stage, the system had been introduced by a number of states and railway companies throughout Germany, and efforts were now directed towards establishing a stable, coordinated financial and logistical framework for their communications infrastructure. As the legislative process would highlight, however, the combination of external and internal pressures upon the state revealed in 1848/9 was systemic.

With no dedicated department to oversee the project, until the creation of a *Telegraphenamt* in Munich in November 1849, the task of proposing an outline for the telegraph network was conferred upon the *Eisenbahnbau-Kommission*.¹⁷ Telegraph lines could be expected to multiply rapidly, however, and the new minister-president Ludwig von der Pfordten twice brought the issue to the attention of the king, Maximilian II, in December 1849 and February 1850. By the latter date, the Munich-Salzburg line was already open to the public, providing a link to Vienna, and

¹⁷ *Regierungsblatt für das Königreich Bayern*, 23 Nov. 1849, pp. 1251-2; BHStA, MH 16799, Bever to Eisenbahnbau-Kommission, 15 Nov. 1849.

construction was underway on the Munich-Augsburg-Nuremberg-Hof line, which was to connect the capital, through Saxony, to Berlin.¹⁸

Pfordten's addresses to the king featured all the characteristics of the discussions which were to take place in government and parliament. To begin with, he repeated the assertion that the 'indispensability' of the technology to the state 'no longer need[ed] further elaboration'.¹⁹ Bavaria was felt to have fallen behind its neighbours, however, and 'the necessity of telegraph lines for Bavaria [...] becomes all the more apparent the further those lines extend which other states have at their disposal, and which can be used for private as well as government purposes'.²⁰ Added to the pressure of integrating an emerging European network was the fact that internal demand would also develop. 'The necessity of a wider expansion of the telegraph network will later without doubt come into play', he wrote.²¹

The government's decision to undertake the construction of a state telegraph network for private purposes reflected the influence of an encroaching liberalism among the king's advisers. Individuals who were active in the administration, such as Wilhelm Joseph Behr, Friedrich von Hermann, and Carl Joseph Kleinschrod, each from their own perspective, adhered to an emerging German blend of Smithian ideas and diluted Cameralism, which called for the state to actively structure an otherwise independently functioning economy. In addition, Maximilian II had decided that the 'social question'

¹⁸ BHStA, MH 16802, Pfordten to Max II, 2 Dec. 1849; BHStA, MH 16799, Pfordten to Max II, 5 Feb. 1850.

¹⁹ BHStA, MH 16799, Pfordten to Max II, 5 Feb. 1850.

²⁰ *ibid.*

²¹ BHStA, MH 16802, Pfordten to Max II, 2 Dec. 1849.

which had surfaced during the recent disturbances might be answered in part by ordering large-scale construction works.²²

Yet work could only proceed once the Bavarian *Landtag* had approved the government's plans, and the means of financing them. Pfordten therefore presented a bill to the *Staatsrat* and the *Landtag*, describing the government's objective as to 'envisage the entire telegraph network as it should be established for Bavaria', based on its recognised utility for private, commercial, as well as policing, strategic and political purposes.²³

As Pfordten had explained to the king, the immediate stimulus for action came from outside: 'The more the telegraphic means of communication now comes into use in other states, the more urgently our own country's interests require its introduction'.²⁴ As the adjoining states of Austria, Switzerland, Saxony, and later Baden and Württemberg began to construct their own networks, new channels of communication were beginning to emerge throughout Europe, and they threatened to bypass Bavaria if it failed to match these efforts.

The urgency of the situation was recognised in both chambers of parliament. The case-handler for the *Kammer der Abgeordneten*, Schnizlein, told the elected deputies that 'the already advanced implementation of these institutions in a number of neighbouring states urgently pushes for it'.²⁵ Graf von Rechberg similarly warned the *Kammer der Reichsräte* that action was necessary 'as Bavaria could otherwise be

²² I. Burkhardt, *Das Verhältnis von Wirtschaft und Verwaltung in Bayern während der Anfänge der Industrialisierung (1834-1868)* (Berlin, 2001), pp. 121-67.

²³ BHStA, Staatsrat 953, 'Gesetz-Entwurf, Herstellung eines Telegraphen-Netzes für Bayern betr.', 26 Mar. 1850.

²⁴ *ibid.*

²⁵ VKA (1849/50), 28 Apr. 1850, p.453.

impacted negatively in matters of trade and communication by neighbouring countries where this installation is already in place'.²⁶

Although the implementation of a telegraph network was accepted by the deputies in principle, its aims and utility remained uncertain. Schnizlein asserted that the telegraph was an object 'whose high importance for the development of the internal life of the state, as well as for the intercourse of states and peoples is not completely recognised nor fully comprehended'. He did have faith in the technology's potential, but it was based upon the 'wonderful expectations which have followed the astonishing progress in its capabilities in the short span of its existence', rather than any firm evidence.²⁷

Whilst it was agreed that the network was to respond to pressing communications needs, Pfordten himself admitted that 'the real demand cannot yet be ascertained precisely'.²⁸ After over a decade of experimentation, moreover, the minister urged caution and explained that it was 'all the wiser only progressively to bring the telegraph network to completion, as further experience and new improvements are brought into use'.²⁹ There were thus certain intrinsic limitations to planning the network in its entirety.

Tied to the unpredictability of the telegraph network's utility was that of its future growth. Schnizlein believed that '[f]or private correspondence, there will indeed be very little utility to be drawn from this, because the object is too new, and the connections not thoroughgoing enough for use by the general public to be facilitated and made comfortable'. As he astutely surmised, however, 'the more this institution is extended,

²⁶ VKR (1850), 12 May 1850, p. 242.

²⁷ VKA (1849/50), 28 Apr. 1850, p.453.

²⁸ BHStA, Staatsrat 953, 'Gesetz-Entwurf', 26 Mar. 1850.

²⁹ *ibid.*

the more its use will become possible and provide many inhabitants of our particular fatherland with significant advantages'.³⁰ This placed the state in a rather uncomfortable predicament, however, as Schnizlein's observation suggested that existing demand was not only impossible to evaluate, but would itself be generated by supplying the service.

It was in fact to deal with this unpredictable growth that some favoured the establishment of a state monopoly in the construction of telegraph lines. From the government's perspective, as Pfordten announced, it was without question that the state should finance the project.³¹ Such a monopoly had a precedent in the postal system, which had been nationalised in Bavaria in 1808. During the 1840s, however, Ludwig I had administered the Bavarian postal network as a source of state revenue, which he unabashedly used to fund his ambitious building projects.³²

If this was to be the state's motivation in managing the telegraph network, then to the liberal deputy and former minister Ludwig Fürst zu Oettingen-Wallerstein it represented another instance of undue authoritarianism. The proposed legislation, he declared, was nothing more than an 'indemnity bill', put forward to justify measures already taken by the state.³³ But new forces were at play, and it was not solely for fiscal reasons that such an institution might be managed by the state. Even in the upper chamber, Graf von Rechberg believed that state management was necessary, not as a source of income, but 'because private industry will be hard put to take possession of this object, whose profitability is still very problematic'.³⁴

³⁰ VKA (1849/50), 2 May 1850, pp. 736-7.

³¹ BHStA, Staatsrat 953, 'Gesetz-Entwurf', 26 Mar. 1850.

³² K. Amtmann, *Post und Politik in Bayern von 1808 bis 1850: Der Weg der königlich-bayerischen Staatspost in den Deutsch-Österreichischen Postverein* (Munich, 2006), pp. 230-44.

³³ VKA (1849/50), 2 May 1850, p. 737.

³⁴ VKR (1850), 12 May 1850, p. 242.

Balancing these geopolitical and domestic pressures directly influenced discussions of the network's general layout. Rechberg, who believed the telegraph should primarily serve political, military and policing purposes, emphasised that 'it is necessary that the government, particularly in these agitated times, rapidly receive knowledge of all developments at the larger courts of Germany and Europe' as well as of internal occurrences.³⁵ The *Reichsräte* added to the bill the requirement that 'the royal state government establish a connection with neighbouring states and a uniform tariff by means of treaties'.³⁶ In the end, the projected outline provided for connections with Salzburg in Austria, Lindau along the Bodensee, Ulm in Württemberg, Frankfurt, Hof towards Saxony and Prussia, and finally, upon the insistence of a member of the *Staatsrat*, Passau as both a fortress and a further point of contact with Austria.³⁷

Internally, meanwhile, the priority had been to connect Munich to the principal seats of local government, fortress towns, and what were termed the 'main channels' of trade.³⁸ The principal 'channel' in question, was the arc running from the north, in Hof, to the south-west, along the border with Württemberg. Above all, the blueprint favoured existing routes of trade, the textile-producing regions of Schwaben and Oberfranken, as well as the incipient machine industry in Nuremberg, to which Munich was simply appended.³⁹ As the evolution of the Bavarian postal network had demonstrated, these were the principal areas of traffic.⁴⁰

Some regions were neglected, notably the Oberpfalz – despite its significance for the mining industry – and, as was often the case, the Pfalz. The latter, situated on the

³⁵ VKR (1850), 12 May 1850, p. 242.

³⁶ VKR (1850), 17 May 1850, pp. 364-76.

³⁷ BHStA, Staatsrat 953, 'Auszug aus dem Protokolle', 26 Mar. 1850.

³⁸ VKA (1849/50), Beil. CXXIX, 28 Apr. 1850, p.453.

³⁹ Burkhardt, *Verhältnis von Wirtschaft und Staat*, pp. 32-9.

⁴⁰ On the evolution of the postal network along these lines, see Z. Segal, 'Communication and State Construction: The Postal Service in the Medium Sized German States, 1815-1866', *Journal of Interdisciplinary History* 44 (2013), pp. 453-73.

left bank of the Rhine, was not even assigned a connection to the Bavarian heartland, as Prussia had established with its Rhineland provinces - which was all the more surprising given the popular revolts which had taken place there following the dissolution of the National Assembly in the summer of 1849, and which the government had struggled to put down.⁴¹ The outline adopted, therefore, did not provide uniform coverage across the state. Rather, it strengthened the connections between existing economic, administrative and military-strategic centres. When Schnizlein recommended establishing a number of intermediary stations along the lines, for instance, it was not to broaden access to the service, but rather to provide multiple channels of communication in case of traffic disruptions which, he correctly foresaw, would become increasingly unbearable to the telegraph's principal users.⁴² As the administration was soon to discover, the final outline for the telegraph network placed the state at the mercy of the driving sectors of its economy, and throughout Germany these were to be its most vocal customers.

The majority of large and medium-sized German states introduced similar telegraph networks during the 1850s, forging internal and external links. Having connected Berlin to Frankfurt, the Prussian government then prioritised the construction of links to its borders, with lines to Cologne, Hamburg, Stettin, Halle, and Breslau, as well as between Düsseldorf and Elberfeld, to serve the textile industry.⁴³ In Saxony, the network initially prioritised both the internal Leipzig-Dresden connection, and that to

⁴¹ J. Sperber, *Rhineland Radicals: The Democratic Movement and the Revolution of 1848-1849* (Princeton, 1991), pp. 414-66; H. Rall, 'Die politische Entwicklung von 1848 bis zur Reichsgründung 1871', in Spindler (ed.), *Handbuch*, iv./1, p. 234; On popular political culture in the Pfalz during the Vormärz, see J. M. Brophy, *Popular Culture and the Public Sphere in the Rhineland, 1800-1850* (Cambridge, 2007).

⁴² VKA (1849/50), 2 May 1850, p. 739; VKA (1849/50), Beil. CXXIX, 28 Apr. 1850, p.453-4.

⁴³ H. A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland* (Wiesbaden, 1983), p. 154.

Hof and Görlitz, providing a connection with Bavaria and Prussia.⁴⁴ Hamburg and Bremen, meanwhile, negotiated connections with Hanover and Prussia.⁴⁵

In the process, the logistical constraints which had necessitated inter-state cooperation in 1848/9 persisted into the 1850s. Baden, Württemberg and Hannover, for instance, had been slow to introduce the state networks, primarily for financial reasons. All three, however, were spurred to action by Bavaria, France, Prussia, Bremen and Hamburg, which relied upon these struggling states' participation in order to connect to foreign territories further afield.⁴⁶

This geography-induced mixture of interstate collaboration and coercion was then given formal expression in the establishment of the *Deutsch-Österreichischer Telegraphen-Verein (DÖTV)* in July 1850. Initially composed of Austria, Prussia, Bavaria and Saxony, these four engines of the German telegraph network soon drew in the remaining German states, generalising technical norms and raising expectations for each member to live up to. The founding treaty required the service to be open to the public, for instance, and set the tariffs for communication between networks. It also encouraged their continuous expansion by linking the proportion of the *DÖTV*'s total revenue which each state received to the length of wires and volume of correspondence on their network.⁴⁷

⁴⁴ *ibid.*, p. 73.

⁴⁵ *ibid.*, pp. 93, 98.

⁴⁶ R. Seidel, 'Verkehrsmittel Telegraph: Zur Geschichte der Telegraphie im 19. Jahrhundert bis 1866 unter besonderer Berücksichtigung des Raumes Hannover – Bremen' (University of Hanover PhD Thesis, 1980), pp. 142-4.

⁴⁷ J. Reindl, *Der Deutsch-Österreichische Telegraphenverein und die Entwicklung des deutschen Telegraphenwesens, 1850-1871* (Frankfurt am Main, 1993), pp. 163-6.

Building the Network: Confronting Commercial Concerns

The law which came into effect on 7 June 1850 was the only major piece of legislation to be passed concerning the Bavarian telegraph network until 1861. Between 1850 and 1854, the branches of the network which had been presented in the initial bill were rapidly constructed, so that by 1855 the 500,000 fl. which had been devoted to the cause were exhausted. Across the state, railways were simultaneously equipped with their own telegraph lines, but the apparatuses they employed for signalling purposes could not be adapted to the needs of general correspondence. As a result, the number of public telegraph stations throughout the kingdom increased only slowly, with 29 in operation in 1854, and 40 in 1857.⁴⁸

Where construction progressed, the telegraph infiltrated existing channels of communication and forged new ones, feeding hopes of inclusion in, and fears of exclusion from the network in the state's most commercially active centres. In general, it was along the sections of the network which had been planned, or where construction had begun, that expectations had been raised and complaints or requests first emerged. Between 1850 and 1854, for instance, requests for inclusion in the telegraph network were received from Bayreuth, Kaufbeuren, Neuburg and Erlangen.⁴⁹ All of these towns were situated directly upon, or within a short distance from the principal arc of communication which the telegraph followed, from the south-west to the north.

It was also from this commercial heartland that the first open criticisms of the network were raised in parliament. In 1854, Ludwig Fürst zu Oettingen-Wallerstein stood to defend the interests of his electoral district of Donauwörth in Schwaben, which

⁴⁸ *Rückblick*, p. 253.

⁴⁹ BHStA, GDVA 438, GDVA to Telegraphenamt, 10 May 1853; BHStA, GDVA 227, 'Bitte des Stadtmagistrats und der Gemeindebevollmächtigten der Stadt Neuburg', 23 Oct. 1853; BHStA, MH 16900, Regierung Schwaben und Neuburg, Kammer des Innern to Handelsministerium, 31 Oct. 1853.

also constituted the historic seat of his family's lands.⁵⁰ As he explained, both Donauwörth and Nördlingen lay along 'the highly important Munich-Hof route', the former a 'junction of railway and steam navigation', and the latter an industrial and haulage hub through which people and freight made their way from Württemberg to the Bavarian railway network.⁵¹ He therefore demanded that a telegraph connection be provided, as it would be pivotal for such a commercially active region.

Wallerstein's proposal concerned more than the interests of his constituency, however. In putting forward the claims of Donauwörth and Nördlingen, he sparked discussions between parliament and government regarding the shape and priorities of the network as a whole. The debates took place over the course of the 1854/5 session of parliament and touched upon all key aspects of the law passed in 1850. The state's role in the implementation of the telegraph was explicitly discussed, as well as the purpose of communications in general. The vicious circle of internal supply and demand which had been raised during the legislative process had now been unlocked, and the vision of a carefully managed network was confronted with the reality of a dynamic, self-generating organism.

Indeed, the debates contributed to a growing tension between the government and the *Kammer der Abgeordneten*, which had been dominated by a liberal majority since July 1849, and opposed the king's perceived efforts to turn his back on the reforms of the revolutionary years.⁵² Wallerstein himself had been chief minister in the 1830s, before Ludwig I's government had taken a conservative turn which led to his dismissal

⁵⁰ 'Oettingen-Wallerstein, Ludwig Fürst', *Allgemeine Deutsche Biographie* 40 (1896), S. 736-747 [Online-Version], accessed 22 Mar. 2017, at <https://www.deutsche-biographie.de/gnd118589555.html#adbcontent>.

⁵¹ VKA (1853/5), Beil. XLIV, 16 Nov. 1854, p. 97.

⁵² Rall, 'Die politische Entwicklung', pp. 243-5.

in 1837.⁵³ During that time, he had promoted a policy of road and railway construction – in addition to the long-awaited *Ludwig-Main-Donau-Kanal* - designed to improve the infrastructure which Montgelaß and his successors had neglected since the beginning of the century. His extensive study of communications routes in Bavaria remained a point of reference into the 1850s, and now a committed liberal in parliament, he was eager to impress upon the government the priority of economic concerns.⁵⁴

In order to be both profitable and of general utility, Wallerstein stated, the network depended upon ‘the most possible use on the part of private individuals’. In most other states, including Bavaria’s similarly-sized neighbours Württemberg and Switzerland, this had been achieved by multiplying the number of branch lines in the network. Not only did this render their networks more profitable by broadening public access to the technology, he also maintained that this preserved the natural balance of competition between towns.⁵⁵

‘Where, however, the telegraphs are only available to a few exchange metropolises’, he continued, ‘trade and industry in other places are placed at a considerable disadvantage; their ability to offer sustained competition with the favoured towns becomes a clear impossibility’.⁵⁶ Wallerstein therefore requested that the telegraph network be extended to ‘all important trading and commercial sites’, and in particular that all sites traversed by existing railway telegraph lines be immediately provided with ordinary, correspondence telegraph stations.

⁵³ M. Spindler, ‘Die Regierungszeit Ludwigs I. (1825-1848)’, in M. Spindler (ed.), *Handbuch der Bayerischen Geschichte* (4 vols., Munich, 1967-75), iv./1, pp. 175-6.

⁵⁴ H.-P. Schäfer, ‘Bayerns Verkehrswesen im frühen 19. Jahrhundert’, in C. Grimm (ed.), *Aufbruch ins Industriezeitalter* (3 vols., Munich, 1985), ii., 308-22.

⁵⁵ VKA (1853/5), Beil. XLIV, 16 Nov. 1854, p. 97.

⁵⁶ *ibid.*

For Wallerstein, therefore, the telegraph should not be allowed to create imbalances within existing networks of communication, and should instead be designed so as to allow fair and unhindered exchange and competition. His petition was presented on behalf of a region of western and south-western Germany traditionally associated with ‘proto-industry’ and a dispersed putting-out system, but for which he believed communication was essential.⁵⁷ Indeed, such a ‘decentralized industrial order’, as Gary Herrigel has instead proposed to view economic structures in these areas, was arguably all the more dependent upon exchange and interaction in order to coordinate the stages of production which were divided between workers and merchants scattered across the landscape.⁵⁸ The telegraph provided a ‘modern’ framework within which these ‘traditional’ methods could persist.

Wilhelm Neuffer, an entrepreneur, and the head of the designated committee for the *Kammer der Abgeordneten*, extended Wallerstein’s argument to the economy and society as a whole. ‘Agriculture, industry and trade are the principal factors of human pursuits, and where they are equally carefully fostered and protected, social relations are also well ordered; but if one of these branches comes to a standstill, disturbances soon emerge, and like uneven rings in a chain, they rub until they disconnect, and so the neglect of the particular impacts the whole, and some progress, salutary in and of itself, creates a lacuna instead of exerting a beneficial influence on the entirety’.⁵⁹ Not only towns, then, but different sectors of economic and social life should be encouraged to dovetail smoothly. Neuffer explained that all similar countries ‘are urgently pressed to develop their installations similarly and to strive for unity, particularly in everything

⁵⁷ Wehler, *Gesellschaftsgeschichte*, ii. 87-9

⁵⁸ G. Herrigel, *Industrial Constructions : The Sources of German Industrial Power* (Cambridge, 1996), esp. pp. 33-71.

⁵⁹ VKA (1853/5), Beil. XLIV, 4 Dec. 1854, p. 96.

which concerns exchange'.⁶⁰ *Verkehr*, he recognised, was central to an economic policy directed towards social stability.

Whilst emphasising unity and equilibrium, however, Neuffer's argument also hinted at the growth which exchange and communication encouraged. 'If one part in anyway moves forward past another, then the other must not stay behind', he explained, and '[i]t is therefore also absolutely natural, that the slightest facilitation of exchange in any part of the country will also everywhere draw out the desire to become a part of it'. It was no wonder, Neuffer believed, that dissatisfactions and criticisms had been raised, especially in the oldest provinces of Bavaria. There, people justifiably felt as though 'one lets everybody pay equally, but does not display the same measure of justice everywhere'.⁶¹ The ultimate objective of the network was to create a level economic playing field, but the current process left some towns and regions to 'catch up' with others.

To Wallerstein, this was only natural. 'Such an institute', he stated, 'is never carried out all of a sudden in its entirety, rather it demands its *development*'. The network would evolve slowly, and all Wallerstein was asking for, he asserted, was 'a further step' towards the 'demands of equity' in this development. Indeed, in other states all commercial towns now communicated with the major stations, whilst certain places in Bavaria were being placed at a disadvantage.⁶²

But this evolutionary process raised fears in parliament. Proceedings there were predicated on reports demonstrating that during the 1851/2 financial year, aside from initial construction costs, the network had run a deficit of around 22,754 fl., rising to

⁶⁰ VKA (1853/5), Beil. XLIV, 4 Dec. 1854, p. 96.

⁶¹ *ibid.*.

⁶² VKA (1853/5), 20 Dec. 1854, p. 364.

39,304 fl. in 1852/3.⁶³ And yet Wallerstein's proposal to broaden access to the technology, though theoretically resulting in greater revenue, involved further immediate investment.

At stake was the state's capacity to keep up with ever-growing demand. For the liberal Gustav Freiherr von Lerchenfeld, its involvement was to be limited. 'In our country, the state caters to everything, must do everything, must have civil servants, civil servants, and yet more civil servants for everything, and where an institute is established today, tomorrow the pensions budget rears its head'. Moreover, he emphasised, technology required constant improvement and repair, which made the budget unpredictable. For these reasons, he opposed all further state expenditure on the extension of the telegraph network.⁶⁴

David Morgenstern, a democrat, and the first Jewish member of the Bavarian parliament, stood to request that his constituency seat of Fürth be provided with a telegraph connection, and reminded his colleagues that the option also existed to adopt an entirely privately-run system, as in England and the United States, and thus to remove the state from the equation.⁶⁵ However, even he admitted that now the administrative structure was in place, they should work with the state for the time being.

The discussion of Oettingen-Wallerstein's proposal resulted in an agreement in March 1855, which marked a victory for liberal proponents of a network structured around economic priorities. Whilst dropping his request to open railway telegraph lines to private correspondence as technically unfeasible, the two chambers nonetheless pressed the government to extend the network to all commercial towns of the kingdom,

⁶³ VKA (1855/6), Beil. XXII, 11 Nov. 1855, p. 392.

⁶⁴ VKA (1853/5), 20 Dec. 1854, p. 364.

⁶⁵ *ibid.*

'Morgenstern, David', *Neue Deutsche Biographie* 18 (1997), p. 108 [Online-Version], accessed 22 Mar. 2017, at <https://www.deutsche-biographie.de/gnd133577244.html#ndbcontent>.

within the scope of the budget. The principal towns which *Ministerial-Commissär* Brück had spotlighted for inclusion in the network were Nördlingen, Donauwörth, Fürth, Kaufbeuren, Erlangen, and Immenstadt, all situated along the state's central commercial channel, and most of whose claims had been raised in parliament.⁶⁶

By November, however, as tensions between government and parliament reached their climax, and with little evidence of any activity on the part of the administration, criticisms were expressed once again. A number of deputies were now particularly forceful in emphasising the economic function of the network. 'I never asked for a telegraph on the Peißenberg', Oettingen-Wallerstein declared, 'but I did want one in Fürth, a town which pays for 10 to 12 times as many telegrams as a single civil servant requires'.⁶⁷ He was supported by Marquard Adolph Barth, who believed the government had misunderstood what constituted an important town – it should be the extent of its industry and trade, he explained, not the number of inhabitants.⁶⁸ As Oettingen-Wallerstein pointed out, even though Bavaria might possess a reasonable number of telegraph stations, if one discounted those established for administrative purposes, 'the number of national-economic and industrial telegraph offices is considerably limited'.⁶⁹

The criticism was later supported by Lerchenfeld, from the standpoint of profitability. There were two 'diametrically opposed' types of network, he believed – one which favoured external relations, and one which prioritised internal necessities. He would never have agreed to the project as a whole, he asserted, had he known that 'we only use the telegraphs to maintain a connection between London and Paris and the Crimea and heaven knows which other external locations'. Why did Bavaria possess

⁶⁶ VKA (1853/5), 20 Dec. 1854, p. 367.

⁶⁷ VKA (1855/6), 22 Nov. 1855, p. 253.

⁶⁸ *ibid.*, p. 254.

⁶⁹ *ibid.*, p. 253.

stations in Coburg, Meiningen and Offenbach, when Fürth, Donauwörth and other commercial towns did not? Simplicity and public utility, Lerchenfeld insisted, should be the priority. Why, for instance, had Ingolstadt and Ansbach been provided with a telegraph connection?⁷⁰

His outburst highlighted the dual problematic of external and internal pressures, an issue also evoked in an article in the *Neue Münchner Zeitung* from November 1855. The article, published before the government's official revenue estimates for 1853/4, revealed that the network was finally running a small profit. As the article pointed out, the arrangements of the *Deutsch-Österreichischer Telegraphen-Verein* meant that the majority of the administration's income in 1853/4 had come from international traffic (both from or to Bavaria, or simply in transit across the country).⁷¹ Given the agitated political circumstances created by the Crimean War, Bavaria had come to constitute a crucial nexus for international European exchanges.

Not only was the Bavarian network a growing entity feeding upon internal demand, it was itself part of a larger, fluctuating system of exchanges. As Lerchenfeld feared, the state now had to cater to external needs as well as internal demands and, as *Ministerial-Commissär* Brück explained, the potential income from international traffic could itself fluctuate according to geopolitical circumstances. This news fuelled Lerchenfeld's anxiety that the state would be called upon to increase its involvement and to 'install telegraph offices in all parts of the heavens'.⁷²

A satisfactory compromise was reached in May 1856, on the basis of the very small declared profit. But the original 500,000 fl which had been granted for major

⁷⁰ VKA (1855/5), 6 May 1856, p. 151.

⁷¹ *Neue Münchner Zeitung*, 3 Nov. 1855.

⁷² VKA (1855/5), 6 May 1856, p. 151.

construction works had long been exhausted, and the revenue in question was too small to envisage considerable work. As the director of the *Telegraphenamt*, Carl Dyck, highlighted to his superiors, if entirely new lines were to be established to those towns outside the railway network – and these, he believed, arguably needed the telegraph the most, - then a new grant would have to be approved.⁷³

As a result, between 1856 and 1862, very little activity on the state's part was undertaken to increase the density of the network. Meanwhile, in reaction to the growing power of left-liberals in the lower chamber, the king first suspended parliament in 1856, and then dissolved it in 1858.⁷⁴ Without consulting parliament, therefore, other avenues were explored which might enable the state to extend the service further.⁷⁵ Bavaria was not alone in facing these issues, and in dealing with the same issue, the 1850s saw Prussia introduce a policy allowing towns to obtain a telegraph station if they covered the costs themselves.⁷⁶

The debates in parliament had clearly filtered through to the administration, however. Despite the ongoing neglect of the Oberpfalz and repeated requests from the Pfalz, the towns given priority were those initially identified by the deputies. Although Dyck highlighted the need to add wires along the existing lines which produced the most revenue, Pfordten insisted upon the need to connect the more commercially significant towns of Fürth, Erlangen, Kaufbeuren, Nördlingen, Donauwörth and Straubing.⁷⁷

Meanwhile, requests for inclusion in the telegraph network continued to pour in, drawn up by municipal authorities, regional chambers of commerce, or even individual

⁷³ BHStA, MH 16799, Dyck, Erinnerung, 8 Dec. 1855.

⁷⁴ Rall, 'Die politische Entwicklung', pp. 243-5.

⁷⁵ *Rückblick*, p. 162.

⁷⁶ Wessel, *Entwicklung des Nachrichtenwesens*, p. 174.

⁷⁷ BHStA, GDVA 227, Dyck, Vortrag, 6 Jan. 1856.

businessmen – all now turned to the state as the provider of infrastructure.⁷⁸ Georg Riedl, owner of the Seedampfschiffahrtsgesellschaft put forward the claims of Rosenheim, for instance.⁷⁹ The interests of Marktbreit, Miltenberg and Kitzingen in the region around Würzburg were defended by the *Handelskammer* for Unterfranken and Aschaffenburg.⁸⁰ Dyck considered these towns as deserving particular attention, alongside Ochsenfurt, Uffenheim, Rothenburg, Dinkelsbühl and Memmingen. All were situated in the parts of Schwaben and Franken which bordered Württemberg, the region of ‘decentralised industrial order’ alongside the main commercial route in Bavaria.⁸¹

With little revenue and no extraordinary funds at its disposal, time and again the government’s response to these requests was that usage in the towns concerned would not cover the costs of construction and maintenance of a telegraph office.⁸² Instead, other means were sought to extend the service without increasing direct expenditures. By 1857, the telegraph offices in railway stations had become better equipped to handle ordinary correspondence, and the decision was made to open them all to the public.⁸³ In one fell swoop, the number of stations from which individuals could send and receive telegrams increased from 40 to 145, and the number of telegrams transmitted increased from 128,000 in 1857 to 207,000 in 1859.⁸⁴

The policy had been introduced in Saxony in 1853, to compensate for its difficulty in financing the network, and it was discussed at a meeting of the *DÖTV*. It was then

⁷⁸ On the influence of local petitions in the construction of railways, see Green, *Fatherlands*, pp. 246-8.

⁷⁹ BHStA, GDVA 227, ‘Gesuch des Spediteurs Georg Riedel’, 28 Oct. 1856.

⁸⁰ BHStA, MH 16876, ‘Auszug aus dem Jahresberichte der Kreis- Gewerbs- und Handelskammer von Unterfranken & Aschaffenburg’, 18 Jan 1856.

⁸¹ BHStA MH 16799, ‘Kostenvoranschlag über die Ergänzung des Telegraphen-Netzes’, 9 Dec. 1855; Herrigel, *Industrial Constructions*, pp. 33-71.

⁸² BHStA, MH 16876, Dyck to HM, 25 Sep. 1856.

⁸³ BHStA, MH 16864, ‘Antrag, die Benützung der Bahnbetriebstelegraphen betr.’, 11 Jun. 1857.

⁸⁴ *Rückblick*, p. 253.

enacted in Prussia and Austria in 1858.⁸⁵ The Pfalz was initially excluded from the measure, but in 1859, after repeated requests from the *Handelskammer* for a wider-reaching service than the single state line which ran along its eastern border, the government granted permission for local railways to transmit private correspondence.⁸⁶

The effect of this shift, however, was double-edged. On the one hand, tying together railway and telegraph services accentuated the impact of their absence in those places which possessed neither. On the other hand, the increased availability of the service in the vicinity of many towns encouraged further demands from communities which had seen wires ‘drawn before their eyes’.⁸⁷ The *Handelsrat* in the town of Marktbreit therefore decided to take matters into its own hands, and to establish a connection to nearby Würzburg ‘using our own means’.⁸⁸

Yet despite the growing chorus of anxious demands from different communities, average local usage of the network was remarkably low. In 1852 and 1854, as Pfordten informed parliament, each office had received only 334 paid telegrams per year, a ‘so noticeably small number, that one should bear in mind when it is claimed that one need only build more stations to ensure profitability’.⁸⁹ Experience had begun to show that even those new stations spotlighted in the parliamentary debates – Donauwörth, Nördlingen, Erlangen, Kaufbeuren and Straubing – had failed to cover their costs.⁹⁰ As the director of the *Telegraphenamt* Carl von Dyck explained, in these places ‘only few,

⁸⁵ Reindl, *Der Deutsch-Österreichischer Telegraphenverein*, pp. 130-4; Landesarchiv NRW Abteilung Rheinland, BR 0005, Nr. 1534, Minn to Oberpräsident von Kleist-Retzow zu Coblenz, 14 Aug. 1858.

⁸⁶ BHStA, GDVA 227, ‘Extract aus dem Jahresbericht der pfälzischen Gewerbs- und Handelskammer’, 6 May 1857; BHStA GDVA 227, ‘Extract aus dem Jahresbericht der pfälzischen Gewerbs- und Handelskammer für 1857’, 13 Apr. 1858; BHStA GDVA 227, ‘Antrag aus dem Jahresberichte der Pfälzishchen Gewerbs- und Handelskammer’, 15 Jan. 1859; BHStA GDVA 227, v. Schrenck to HM, 5 May. 1859.

⁸⁷ BHStA, MH 16902, Jahresbericht der Kreis- G und HK von Oberpfalz und Regensburg für 1859, p. 21.

⁸⁸ BHStA, MH 16876, Handelsrat Marktbreit to HM, 19 May 1858.

⁸⁹ VKA (1855/6), 22 Nov. 1855, p. 256.

⁹⁰ BHStA, GDVA 227, ‘Erinnerung des Telegraphenamts-Vorstands’, 4 Mar. 1858.

individual tradespeople or manufacturers might have an interest in using the telegraph here and there'.⁹¹

Dyck's observation was particularly revealing. The state had progressively acceded to the demands emanating from its commercial centres, but he suggested that the requests to which it had been responding were those of a small, anxious and vocal minority. From a distance, the authorities beheld the spectacle of a pulsating, growing network, but it was beating to the rhythm of a privileged social stratum. Throughout Germany and Europe, the wiring of towns, regions, and states was primarily enhancing the support structure of a business community.

Using the Network: The Business Community

Statistics are notoriously difficult both to obtain and to assess during this early period, due to their scarcity and the differences in the information which was recorded. Nevertheless, a ten- to twentyfold increase in the volume of traffic across German networks between 1850 and 1860 suggests there had been an enthusiastic uptake of the service. During the decade, the number of telegrams handled annually in Württemberg rose from 7,000 to 100,000; in Bavaria from roughly 10,000 to 200,000; and in much larger Prussia, from 35,000 to 600,000.⁹²

On the other hand, the network's coverage within the population was rather limited. In 1855, there was one telegraph office for every 27,000 inhabitants in Switzerland, 34,018 in the United States, 60-65,000 in England and Saxony. Bavaria

⁹¹ BHStA, GDVA 227, 'Erinnerung des Telegraphenamts-Vorstands', 4 Mar. 1858.

⁹² F. Weber, *Post und Telegraphie im Königreich Württemberg* (Stuttgart, 1901), p.239; *Rückblick*, p. 253; F. Kilger, *Die Entwicklung des Telegraphenrechts im 19. Jahrhundert* (Frankfurt am Main, 1993) p. 48.

had one office for every 190,000 souls, whilst the figure was 265,000 in France, 344,000 in Prussia and 634,000 in Austria.⁹³

Where statistics are available or can be inferred at a local level in Bavaria, moreover, it seems that few telegrams were being sent or received with any degree of regularity. In its second year of service, for instance, the telegraph office in Nuremberg had only been handed 262 private telegrams, fewer than one per day.⁹⁴ In Kaufbeuren, where the service had been loudly requested, only 48 private telegrams were sent over a period of three months in 1857.⁹⁵ Even in industrious Augsburg, in just under a year between 1858 and 1859, an average of 8 private messages per day were handed in for transmission, a number which, it was explicitly reported, ‘fully occupies neither a telegraphist nor a messenger’.⁹⁶

As Carl Dyck had suggested, it was a small class of interested individuals within each municipality that initially made use of the technology. These individuals were most often news agents, newspaper editors, bankers, merchants, and, to a lesser extent, local manufacturers or services, whose existing business practices already relied upon long-distance communication. The proportion of traffic occupied by each group is not available for every state, but details are available for Prussia. Out of a total of 218, 606 private telegrams sent in 1857, around 45% were ‘trade’ or ‘business’ telegrams; roughly 29% (63,000) were classed as ‘*Börsen-Depeschen*’; a further 4% (9,000) were newspaper telegrams; and under 25% were ‘family’-related.⁹⁷

⁹³ Knies, *Der Telegraph*, pp. 127-8.

⁹⁴ K. Wiesemeyer, ‘Die Post als Verkehrsträger’, in G. Hirschmann and W. Schultheiss (eds.), *Verkehrsentwicklung Nürnbergs im 19. Und 20. Jahrhundert* (Nuremberg, 1972), pp. 298-301.

⁹⁵ 5th Oct. 1857, Telegraphen-Station Kaufbeuren to Telegraphenamt, BHStA GD der VA 197;

⁹⁶ BHStA, MH 16882, GDVA to HM, 21 May 1859.

⁹⁷ Reindl, *Der Deutsch-Österreichischer Telegraphenverein*, p. 286.

As these figures suggest, although commercial users of the telegraph represented only a small proportion of each town's population, they dominated traffic on the network as a whole. These were the individuals for whom exclusion bore the most severe consequences, and who were particularly vocal in advocating its introduction as a result. In the first year of the network's operation in Prussia, indeed, a telegram containing up to 20 words sent from Berlin to Hamburg was charged at a rate of 2 Taler and 30 Silbergroschen. At that time, the average weekly earnings of a worker employed in the crafts or industry stood at roughly 2 Taler, suggesting that telegraphy remained very much beyond the reach of the greater part of the population.⁹⁸

The news industry was one of the first sectors to establish regular use of the telegraph, and agencies emerged which were dedicated to obtaining and redistributing information from across the world. In Germany, the most renowned was undoubtedly Wolff's in Berlin, established in 1849, which later developed close connections with the German government and became a part of the great European news cartel, alongside Reuters and Havas.⁹⁹ But others were established throughout Germany, including Reuter's in Aachen (before moving to London), Bösmann's in Bremen, and others in Frankfurt.¹⁰⁰

Often, however, newspapers themselves established direct contracts with telegraph administrations, and among the earliest in Bavaria was the *Allgemeine Zeitung*, published in Augsburg by the renowned Cotta'sche Buchhandlung. Before the first line between Munich and Salzburg had even been completed, the establishment's subsidiary in Munich had enquired with the *Telegraphenamt* about establishing a

⁹⁸ Reindl, *Der Deutsch-Österreichischer Telegraphenverein*, pp. 70-1.

⁹⁹ A. Nalbach, "'Poisoned at the Source'?: Telegraphic News Services and Big Business in the Nineteenth Century', *Business History Review*, 77, No. 4 (2003), pp. 577-610.

¹⁰⁰ C. Wunderlich, 'Telegraphische Nachrichtenbureaus in Deutschland bis zum Ersten Weltkrieg', in J. Wilke (ed.) *Telegraphenbüros und Nachrichtenagenturen in Deutschland* (Munich, 1991), pp. 23-85.

monthly subscription for regular updates on the course of the Vienna stock exchange.¹⁰¹ In Nuremberg, meanwhile, the *Korrespondent von und für Deutschland* placed a request for the same information, and a similar monthly arrangement, within a day of the town office's inauguration.¹⁰² By December 1850, the *Allgemeine Zeitung* was also receiving regular news on stock market fluctuations from an agent in Frankfurt.¹⁰³

News reports also began to be exchanged telegraphically, but the practice took hold only very slowly. Within days of the Munich-Salzburg line's inauguration, the *Allgemeine Zeitung* began to obtain such reports from Vienna.¹⁰⁴ Further evidence suggests that the newspaper also made use of the telegraph offices in Aschaffenburg and Hof, presumably to receive news from correspondents in Frankfurt and Leipzig respectively, or perhaps even Berlin.¹⁰⁵ In Würzburg, meanwhile, the *Neue Würzburger Zeitung* also asked the *Telegraphenamt* if a reduction in the tariff might apply to the newspaper, as it would like to receive telegrams of up to 100 words on a daily basis.¹⁰⁶ These arrangements were typical across Germany, including in those regions served by a news agency. As Jürgen Wilke has demonstrated, even those newspapers in Berlin which had connections to Wolffs tended to rely on their own correspondents in the field. His survey of the *National-Zeitung* and the *Vossische Zeitung* suggests that this was the case even through to 1919.¹⁰⁷

As long as it remained costly and technically cumbersome to exchange lengthy messages, however, the greater part of the news reported telegraphically was the daily

¹⁰¹ BHStA, GDVA 673, J.G. Cotta'sche Buchhandlung to Telegraphenamt, 11 Jan. 1850.

¹⁰² BHStA, GDVA 673, Institut des Correspondenten to Handelsministerium, 11 Jun. 1850.

¹⁰³ BHStA, GDVA 673, Literarisch-artistische Anstalt der J.G. Cotta'schen Buchhandlung to HM, 9 Dec. 1850.

¹⁰⁴ BHStA, GDVA 673, J.G. Cotta'sche Buchhandlung to Telegraphenamt, 20 Jan. 1850.

¹⁰⁵ BHStA, GDVA 673, Dyck to Telegraphen-Station Hof, 15 Jul. 1850; BHStA, GDVA 673, Expedition der *Allgemeine Zeitung* to Telegraphenamt, 19 Oct. 1850.

¹⁰⁶ BHStA, GDVA 673, Verlegerin der Neuen Würzburger Zeitung to Telegraphenamt, 28 Oct. 1850.

¹⁰⁷ J. Wilke, 'Die telegraphischen Depeschen des Wolff'schen Telegraphischen Büros (WTB)', *Publizistik*, 49, no. 2 (June, 2004), pp. 125-151.

run of stock prices. Once again, Wilke suggests that this was the case in Berlin, too, where Wolffs' primary function was the distribution of financial information to its subscribers.¹⁰⁸ News agencies and newspapers had begun by plugging into the circulation of financial information upon which the business community depended, and served as a further outlet for their distribution.

The *Allgemeine Zeitung*, for instance, became a crucial node in local and inter-state banking and trading networks. In 1851, the banker Heinzelmann in Augsburg explained that the newspaper there 'receives the Vienna exchange rates daily by telegraph, between 1pm and 2pm, and distributes these to all exchange houses here, [...] in keeping with an agreement, daily between 3pm and 4pm'. The benefits of this information were recognised locally, but also across the border in Württemberg. Heinzelmann went on to explain that his colleagues Gebrüder Benedict, bankers in Stuttgart, wanted to be part of the news-sharing arrangement.¹⁰⁹

On a number of occasions, the *Allgemeine Zeitung* changed the stock listings for which it wished to receive regular updates, reflecting its readers' changing demands and the evolution of investment practices.¹¹⁰ As early as June 1850, the newspaper's representative in Munich had asked no longer to obtain news on the Vienna *Stadt-Banco* or the *Hofkammer-Obligationen*, and instead to obtain the prices of the Vienna Bank shares, railway shares and the rate of exchange for silver. Eager to maintain the quality of its service and its readers' loyalty, moreover, the *Allgemeine Zeitung* was soon pressing the government to establish a direct connection with Frankfurt.¹¹¹

¹⁰⁸ Wilke, 'Die telegraphischen Depeschen'

¹⁰⁹ BHStA, GDVA 673, Banquier Heinzelmann to Telegraphenamt, 2 Jun. 1851.

¹¹⁰ BHStA, GDVA 673, Literarisch-artistische Anstalt der Cotta'sche Buchhandlung to Telegraphenamt, 17 Jul. 1852; BHStA, GDVA 673, Literarisch-artistische Anstalt der Cotta'sche Buchhandlung to Telegraphenamt, 28 Jan. 1856.

¹¹¹ BHStA, GDVA 673, Expedition der Allgemeinen Zeitung to Telegraphenamt, 23 Oct. 1852.

News agencies and newspapers were thus crucial links in a chain connecting bankers within and beyond Bavaria. In Augsburg, in particular, the telegraph offered a remedy to the town's declining position on international financial markets. After the end of the Napoleonic Wars, its bankers had primarily traded in government debts, but as these had progressively been repaid, its source of business had dried up. The situation had worsened when Ludwig I chose to establish the Bayerische Hypotheken- und Wechselbank in Munich – exceptionally, as a joint-stock bank – in 1834.¹¹² Now, however, Augsburg's elite were given an opportunity to recover the town's status as a second-tier financial centre.

One of the town's principal bankers, Paul von Stetten, for instance, acted as the intermediary between the Königlich Württembergische Hofbank and the Bavarian telegraph administration, requesting that his colleagues be sent particular stock listings.¹¹³ Heinzelmann, meanwhile, proposed a weekly subscription to stock market updates, which would be exchanged between Vienna, Augsburg and Stuttgart.¹¹⁴ Both von Stetten and Heinzelmann were leading figures in the local protestant elite, whose capital had supported the early stages of industrialisation in Augsburg by investing in the Munich-Augsburg railway line, and large mechanised textile manufactures.¹¹⁵ They now sought to use the technology to their advantage, adapting their banking practices to changing circumstances.

Frankfurt am Main was similarly one of the earliest hubs of telegraphic business correspondence. Although the Bavarian network did not initially provide a direct connection to the city, the telegraph office which opened in Hanau in 1852 became its

¹¹² F. Möller, *Bürgerliche Herrschaft in Augsburg, 1790-1880* (Munich, 1998), pp. 137-50.

¹¹³ BHStA, GDVA 673, Paul von Stetten to Telegraphenamt, 5 Jul. 1851.

¹¹⁴ BHStA, GDVA 673, Heinzelmann to Telegraphenamt, 2 Jun. 1851.

¹¹⁵ Möller, *Bürgerliche Herrschaft*, pp. 148-50.

closest link to the city. Immediately, one of its leading bankers, Andreas Grunelius, warned the new telegraph station that it would ‘often’ be receiving telegrams from his correspondent in Vienna, via an agent in Munich, and asked that they be forwarded from Hanau to Frankfurt ‘by railway, or if necessary, immediately by express post’.¹¹⁶ Another member of Frankfurt’s banking elite, Benedikt Hayum Goldschmidt, meanwhile, was sent an overview of the *DÖTV*’s state lines as a courtesy, as the person who, through the station in Hanau, had ‘used the Bavarian state lines and those of the *DÖTV* the most for his extensive private correspondence’.¹¹⁷

The office in Hanau expected considerable traffic from Frankfurt, and asked the head of the *Telegraphenamt* Carl von Dyck, whether it was acceptable to transmit telegrams whose address was ciphered. Illustrating the administration’s efforts to accommodate the network’s principal users, Dyck replied that ‘one should always favourably accommodate the depositors of telegrams, and in particular those trading houses which often use the state telegraph for their correspondence, and show them the greatest facilitation’, although in this particular matter, the regulations called for such requests to be ‘politely refused’.¹¹⁸

It was not only bankers, nor these traditional centres of finance alone, which came to expect information on price fluctuations. The Hypotheken und Wechselbank as well as the banker Salomon Rau in Munich, the merchants Roth & Sohn in Meiningen, and the banker Frank Hirsch in Landau, for instance, all sought to establish subscriptions with the telegraph administration for regular updates on the Vienna and Frankfurt stock

¹¹⁶ BHStA, GDVA 673, Grunelius, to Telegraphenbureau Hanau, 17 Apr. 1852.

¹¹⁷ BHStA, GDVA 673, Dyck to Banquier B.H. Goldschmidt, 4 March 1852.

¹¹⁸ BHStA, GDVA 673, Dyck to Telegraphenstation Hanau, 17 May 1852.

exchanges, or for favourable rates.¹¹⁹ Similar subscriptions were negotiated with larger representative bodies, such as the *Handels-Gremium* in Munich, the *Handelskammer* in Frankfurt, and the *Handelsvorstand* in Würzburg, suggesting that the business community as a whole was attentive to the vagaries of the stock market.¹²⁰

From an early stage, therefore, the telegraph had extended the influence of financial markets, arguably democratising business practices by allowing a larger audience to partake in what was often denounced as injudicious speculation. Stock trading was not the only function of the network, however. In 1854, for instance, the *Landshuter Zeitung* requested a weekly update on cereal prices, pointing to the growing dependency of local producers and merchants upon cycles of supply and demand in other markets, even in agricultural regions.¹²¹

Overall, then, the telegraph began by transforming, though not necessarily ‘revolutionising’ commerce and finance, in particular. Just as the network was able to both support the existing production structures of south-western Germany’s ‘decentralised industrial order’ and fuel the development of new, concentrated industries, so it also provided a common framework for traditional banking practices and stock market speculation. Despite the importance of stock trading in mobilising the large amounts of capital required for industrialisation, the period 1830-80 has even been described as the ‘hey-day’ of private banking.¹²²

¹¹⁹ BHStA, GDVA 673, Dyck to Handelskammer Frankfurt, 27th Oct. 1854; BHStA, GDVA 673, Handels-Vorstand Würzburg to Telegraphenamt Würzburg, 19 Dec. 1854; BHStA, GDVA 673, Telegraphenamt to Banquier Rau, 5 Mar. 1856; BHStA, GDVA 673 Kaufmann Roth & Sohn to Telegraphenamt, 28 Jan. 1856.

¹²⁰ BHStA, GDVA 673, Dyck to Cotta’sche Buchhandlung, 9 Feb. 1851.

¹²¹ BHStA GDVA 673, Expedition der Landshuter Zeitung to Telegraphenamt, 18th Dec. 1854.

¹²² D. Ziegler, ‘German Private Banks and German Industry, 1830-1938’, in Y. Cassis and P. Cottrell (eds.), *The World of Private Banking* (Burlington, 2009), pp. 159-76.

Unlike in Britain or France, until the 1870s Germany's financial network remained considerably decentralised, and the telegraph initially maintained, perhaps even enhanced this structure.¹²³ A 'merchant banking' centre such as Hamburg was placed alongside Frankfurt, which specialised in trading government debt, as well as Vienna, Berlin, and Munich, where railway shares were more easily listed, whilst Augsburg, which had shown little interest in securities trading, now functioned as a junction between southern financial hubs. The modern framework of communication provided by the telegraph network could thus give renewed vigour to traditional areas of investment – Frankfurt's connectedness enabled it to profit from the American Civil War, for instance, having been chosen as the market for the listing of the Northern States' bonds.¹²⁴

Enhanced communication thus built upon existing structures and spawned new centres. Frankfurt's '*Effectensocietät*', had only been formally established in the 1830s, and it had immediately introduced a pigeon-carrier service to Madrid and Paris.¹²⁵ On the other hand, a stock exchange would only emerge in Dresden in 1857, Stuttgart in 1860, and Dusseldorf in 1874.¹²⁶ Many of the names which appear in the sources, from Gebrüder Benedikt, to B.H. Goldschmidt, and Salomon Rau hint at the continued significance of networks of communication within the elite of the Jewish community which had long enabled them to mobilise financial resources.¹²⁷ The point should not be

¹²³ Michie, *Global Securities*, p. 96-7.

¹²⁴ C.-L. Holtfrerich, *Frankfurt as a Financial Centre: From Medieval Fair to European Banking Centre* (Munich, 1999), p. 148.

¹²⁵ *ibid.*, p. 161.

¹²⁶ Michie, *Global Securities*, p. 96.

¹²⁷ Seigel, *Modernity*, pp. 376-410; see also: W. Mosse, *Jews in the German Economy: The German-Jewish Economic Elite, 1820-1935* (Oxford, 1987), pp. 34-68; G. Kurgan-van-Hentenryk, 'Jewish Private Banks', in Cassis and Cottrell (eds.), *The World of Private Banking*, pp. 213-30.

overemphasised, however, as many other private bankers clearly depended upon similar means.¹²⁸

There were also more spontaneous, sporadic users of the telegraph, and whilst it is difficult to establish firm statistics on the matter, the available evidence suggests that these were primarily merchants or traders with potentially long-distance connections. One of the very first private complaints received by the *Telegraphenamt* in Munich, for example, was from a local wholesale dealer with connections in Vienna.¹²⁹ An early vocal proponent of the establishment of a telegraph station in Bayreuth was the merchant Wilmersdörffer.¹³⁰ Other identifiable users included the *Main-Dampfschiffahrts-Gesellschaft*, which sent perhaps 30 telegrams in one year.¹³¹

Other aristocratic or wealthy individuals also took advantage of the new means of communication to maintain existing social connections. Telegraph offices were called for in popular holiday destinations such as Bad Kissingen or Bad Reichenhall, and the technology enabled the aristocracy to keep track of each other's peregrinations.¹³² These were the circles which could afford to make the technology a part of everyday practice, as when Duchess Alexandrine of Coburg messaged her husband from Frankfurt to announce that she had 'finally arrived. Very tired. Will leave again at 12'.¹³³

On the other hand, having repeatedly emphasised the undeniable utility of the telegraph for its own purposes, the state in fact made very little use of it. To be sure, the technology would soon come to underpin diplomatic practices, in which networks of

¹²⁸ See, for example, M. Körner, 'Protestant Banking', in Cassis and Cottrell (eds.), *The World of Private Banking*, pp. 231-46.

¹²⁹ BHStA, GDVA 673, J. N. Oberndörffer to Handelsministerium, 25 Feb. 1850.

¹³⁰ BHStA, GDVA 438, S. M. Wilmersdörffer to Telegraphenamt, 15 Aug. 1852.

¹³¹ BHStA, GDVA 673, Telegraphen-Station Würzburg to Telegraphenamt, 29 Sep. 1852.

¹³² BHStA GDVA 227, MInn to MA, 17 Nov. 1856.

¹³³ BHStA, GDVA 680, Telegram from Frankfurt to Coburg, 8 Sep. 1858.

communication had long been essential.¹³⁴ Throughout Bavaria, however, only 459 state telegrams were sent during the first six months of 1851.¹³⁵ The volume certainly increased over the course of the decade, but at a local level and across state institutions, the technology was slow to integrate administrative practices.

In 1851, for instance, the *Regierung* in Ansbach asked each one of its subordinate departments to ‘collect [their] observations and assessments concerning the manner in which [they] might make use of this state institute’ over the following three months.¹³⁶ The Nuremberg *Magistrat* replied that it had only made use of the telegraph twice until now, and that its use was so rare as to make the requested observations impossible.¹³⁷ Neither the *Landgericht* nor the *Rentamt* had made any use of the service either.¹³⁸ Indeed, in 1851, only 146 telegrams were sent from all the state departments in Nuremberg, less than one every two days.¹³⁹ The *Stadt-Kommissariat* and *Stadtmagistrat* in Schwabach, which possessed no telegraph station, even admitted that its installation was not particularly necessary.¹⁴⁰

Meanwhile, the telegraph had been introduced in the governmental seat of nearby Ansbach, in order to monitor the unstable political situation in Nuremberg, but a year later reports suggested that its use had been uneconomically low. In 1852, the telegraphist in Ansbach expressed the desire ‘to be kept busy with telegrams more often’, as only 70 telegrams had been handled since the beginning of the service - the

¹³⁴ D. Headrick, *The Invisible Weapon: Telecommunications and International Politics, 1851-1945* (New York, 1991), pp. 73-5; D. P. Nickles, *Under the Wire: How the Telegraph Changed Diplomacy* (Cambridge, Mass., 2003).

¹³⁵ *Verordnungs- und Anzeige-Blatt für die K. Bayerischen Verkehrs-Anstalten* (1851), p. 290.

¹³⁶ StAN, Rep. 270/IV, Nr. 4, Circular, Präsidium Regierung Mittelfranken, 3 Feb. 1851.

¹³⁷ StAN, Rep. 270/IV, Nr. 4, Magistrat Nürnberg to Präsidium Regierung Mittelfranken, 3 May 1851.

¹³⁸ StAN, Rep. 270/IV, Nr. 4, Landgericht Nürnberg to Präsidium Regierung Mittelfranken, 7 May 1851; StAN, Rep. 270/IV, Nr. 4, Rentamt Nürnberg to Präsidium Regierung Mittelfranken, 18 May 1851.

¹³⁹ Wiesemeyer, ‘Die Post als Verkehrsträger’, p. 298.

¹⁴⁰ StAN, Rep. 270/IV, Nr. 4, Stadt-Kommissariat Schwabach to Präsidium Regierung Mittelfranken, 12 Apr. 1851; StAN, Rep. 270/IV, Nr. 4, Stadt-Magistrat Schwabach to Präsidium Regierung Mittelfranken, 14 Apr. 1851.

local authorities were therefore encouraged to make more frequent use of the service.¹⁴¹ Late into the 1850s, the situation remained similar. In Kaufbeuren, during a period of three months in 1857, only three state telegrams were handled.¹⁴² In Augsburg, by the end of the decade, on average only one state telegram was either sent or received on a daily basis.¹⁴³

De-Synchronisation

The telegraph had begun by strengthening and re-fashioning pre-existing networks of primarily economic, but also social interaction, often cutting across borders, and had thereby spotlighted to the state the growing power of the commercial class to which it catered. Whether it was used for commercial, administrative or diplomatic purposes, however, the telegraph set its users apart from those unable to gain access to the service. Within the privileged, ‘networked’ community, communication could take place at a higher speed. Different sections of society thereby found themselves ‘de-synchronised’, executing their personal and professional transactions according to older or newer rhythms.

Wherever the technology was introduced for state purposes, it interfered with existing administrative hierarchies. For instance, the government in Ansbach, the regional administrative capital of Mittelfranken, complained that it had been left out of the original blueprint for the network, to the benefit of neighbouring Nuremberg, which was of more commercial significance.¹⁴⁴ The government of the Pfalz, meanwhile,

¹⁴¹ StAN, Rep. 270/IV, Nr. 4, Präsident Mittelfranken to von Zwehl, 24 Sep. 1852.

¹⁴² BHStA, GDVA 197, Telegraphen Station Kaufbeuren to Telegraphenamt, 5 Oct. 1857.

¹⁴³ BHStA, MH 16882, ‘Übersicht der Ergebnisse des Telegraphen-Betriebs’.

¹⁴⁴ StAN, Rep. 270/IV, Nr. 4, Draft of letter from Regierung Ansbach to HM, 14 Nov. 1850.

complained that the region had been neglected, and requested permission to use the nearby railway telegraph.¹⁴⁵

The importance of obtaining a telegraphic connection at this stage lay not necessarily in its utility for regular transactions, but in the symbolic and effective advance in communication which it conferred upon those with access to it. These two effects were highlighted in 1851, when a Hungarian revolutionary was spotted near Bayreuth. Although warnings had been sent from Munich to neighbouring Bamberg, where the conspirator had been identified, the authorities in Bayreuth were unaware of this communication and the suspect fled to Bohemia. The *Präsident* of Oberfranken in Bayreuth wrote to the Minister of Trade explaining that ‘24 hours earlier, warrants could have been sent out to capture [him] if it were possible to telegraph from Munich to here as well as Bamberg, - a time loss which in such a case, and given the ease with which one can use the railways to escape police deployments, cannot be compensated for’.¹⁴⁶

In cases such as these, the new technology returned to the authorities the temporal advantage which they had lost with the advent of rail transportation. As the mayor of Augsburg wrote to the *Magistrat* of Nuremberg: ‘The use of the railway is no longer sufficient, because the criminal can make use of it too, and has already obtained a head-start. The most reliable means of rapid pursuit is the electro-magnetic telegraph’.¹⁴⁷

The *Präsident* of Oberfranken’s complaint also underscored the fact that the telegraph had introduced a temporal element into the administrative hierarchy. The *Stadt-Kommissär* in Bamberg had received information by telegraph ahead of the

¹⁴⁵ BHStA, MH 16876, Regierung Pfalz to HM, 2 Jan. 1856.

¹⁴⁶ BHStA, MH 16799, Regierung Oberfranken to HM, 28 Apr. 1851.

¹⁴⁷ Stadtarchiv Nürnberg, C 7/I, Nr. 2762, Erster Bürgermeister Augsburg to Magistrat Nürnberg, 30 Oct. 1850.

Präsident himself. Despite the message's explicit address to the latter, it arrived in Bamberg on 17 April at 3pm, only to be received in Bayreuth on 19 April by post. Until Bayreuth's own telegraph office was opened, all such telegrams, he demanded, should be forwarded to him from Bamberg with the next post.¹⁴⁸

Within the business community, moreover, the time-sensitivity of the information which circulated was often the reason why individuals turned to the telegraph, and was itself accentuated by the technology. Thus, the Augsburg banker Heinzelmänn quoted earlier wrote to the telegraph administration to enquire whether the exchange rates which he received through the *Allgemeine Zeitung* might be sent by the administration directly to his colleagues in Stuttgart. Otherwise, he would have to forward them himself by depositing them once again at the telegraph office: 'it would be 4pm or 5pm before the telegraph office here receives our telegram, and its content would reach Messrs Gebrüder Benedict so late, that they could not achieve their purpose'.¹⁴⁹ Similarly, when the *Landshuter Zeitung* asked for weekly notices on cereal prices, it was insisted that they should not be sent if they would arrive past 5pm, at which point they had lost all value.¹⁵⁰

What often distinguished the use made of the telegraph by news distributors and the finance community was the *Abonnements*, or subscriptions, which they established to secure a regular influx of precise information. The subscription model had been exemplified in Hamburg and Bremen in the 1840s, when both cities had introduced a regular service announcing the arrivals and departures of ships further downstream in Bremerhaven or Cuxhaven, using an optical telegraph. Local merchants and ship-

¹⁴⁸ BHStA, MH 16799, Regierung Oberfranken to HM, 28 Apr. 1851.

¹⁴⁹ BHStA, GDVA 673, Banquier Heinzelmänn to Telegraphenamt, 2 Jun. 1851.

¹⁵⁰ BHStA GDVA 673, Expedition der Landshuter Zeitung to Telegraphenamt, 18 Dec. 1854.

owners then subscribed to receive this information, often at the *Börse*.¹⁵¹ The telegraph encouraged the formalisation and categorisation of these practices. It was only in 1851, for instance, that the Frankfurt *Effectensocietät* began to provide an official listing of stock prices, and the telegraph administration encouraged its customers to use standardised tables, or ‘*Blanquetten*’, when communicating the information.¹⁵²

The new rhythms of communication introduced by the telegraph highlighted cultural distinctions even within the business community itself. In Frankfurt, when a telegram was ‘handed to the Israelite banking house E.M. Vrane on Friday [...] at 7:50 pm, after the Sabbath had begun’, the addressee refused to sign the delivery receipt because of it was ‘forbidden by his religious statutes’, and asked that it be brought to him after 9 pm on Saturday.¹⁵³ As the local chief engineer pointed out, this was often the response among Jewish bankers, namely the Rothschilds, Grunelius, Goldschmidt and Weiller, and yet the regulations were intended to ensure the privacy of telegrams.¹⁵⁴

It was Mayer Amschel Rothschild himself who had bought the rights for Jews to engage in commodity and loan trading in the early nineteenth century, but their reception within the community had been mixed. This particular issue arose in 1854, the year in which Jews were finally granted full political rights by the city, and suggests some of the ‘modern’ pressures being exerted upon the community to adapt to the city’s secularising schedules.¹⁵⁵ In this case, Dyck in Munich asserted that exceptions to the

¹⁵¹ See Chapter Two, p. 119.

¹⁵² Holtfrerich, *Frankfurt as a Financial Centre*, p. 161; BHStA GDVA 673, Telegraphenamt to Banquier Heinzelmann, 3 Jun. 1851.

¹⁵³ BHStA, GDVA 673, Telegraphen-Station Frankfurt to Telegraphenamt, 4 May 1854.

¹⁵⁴ *ibid.*, note from engineer Saifert.

¹⁵⁵ Holtfrerich, *Frankfurt as a Financial Centre*, p. 120.

rule might be made, so that ‘the public will recognise that particular circumstances and wishes are taken into account’.¹⁵⁶

The distinction which was established between those included and those excluded from the network was vividly experienced in the twin textile producing towns of Elberfeld and Barmen, in the Wupper valley of the northern Rhineland. Elberfeld had been provided with a telegraph office from an early stage - a crucial aid in an industrialising district with no direct means of communicating with the principal nearby waterways – the Rhine and Ruhr. It is also likely that the importance of the town’s banking network, which was at the heart of local investments in the railway industry, was decisive in procuring the service at an early stage.¹⁵⁷

The inhabitants of Barmen, on the other hand, had not had such luck, and were obliged to send their messages through the office in Elberfeld. Those who had suffered most from this disparity, the trading establishments (*Handlungshäuser*) of Barmen, therefore presented a joint petition to the Prussian minister of trade, August von der Heydt.¹⁵⁸ The minister was himself from a merchant and banking family based in Elberfeld, a further connection which had no doubt contributed to the town’s early inclusion in the Prussian network, and which added to the sense of injustice. Time was being lost, the petitioners explained, sending telegrams to and from Barmen by post, so that they might be forwarded from Elberfeld’s telegraph station. As a result ‘the telegrams of competing establishments of this neighbouring town are given such a head-start, which, in local transactions, can be extended to our disadvantage’.¹⁵⁹

¹⁵⁶ BHStA, GDVA 673, Telegrafen-Station Frankfurt to Telegraphenamt, 4 May 1854.

¹⁵⁷ Ziegler, ‘German Private Bank’, p. 161.

¹⁵⁸ Stadtarchiv Wuppertal, Q II 15, Vertreter der Handlungshäuser to von der Heydt, 23 Feb. 1856.

¹⁵⁹ *ibid.*

The petition analysed the average time lost by telegrams in transit from the telegraph office in Elberfeld to Barmen, as well as that necessary to send a response, and contained fifty signatures.¹⁶⁰ It highlighted the commercial value of time and the related disadvantage of being disconnected from the network, and relegated to a slower pace of life. In the Wupper valley, two neighbouring communities functioning along similar economic lines, sharing similar social and geographical production and trade networks had thus effectively been set to different time zones, or rather, distinct rhythms of business.

The response from the Prussian government was increasingly common throughout the country at the time: a telegraph office could be established in Barmen if some of its members agreed to underwrite the costs incurred. 45 local establishments agreed to provide this guarantee, demonstrating both the felt necessity of the connection, and the state's acquiescence to a degree of self-management on the part of its production sector, in light of the unpredictable and unmanageable growth of the network.¹⁶¹

Over time, technical constraints threatened to create disparities even between those connected to the network. The request put forward to parliament by Oettingen-Wallerstein in 1854, for instance, evoked the delays which had begun to creep in to the service. As Wallerstein spoke, the first major European conflict was underway in which the telegraph was to play a crucial role. Indeed, the Crimean War provided one of the first opportunities for political leaders to intervene from a distance in developments on the battleground, generally to the dismay of officers on site.¹⁶² As a result, it also stimulated the development of Russia's telegraph network, as well as that of the

¹⁶⁰ Stadtarchiv Wuppertal, Q II 15, Vertreter der Handlungshäuser to von der Heydt, 23 Feb. 1856.

¹⁶¹ Stadtarchiv Wuppertal, Q II 15, Auszug aus dem Protokoll des Gemeinderaths von Barmen, 15 Apr. 1856.

¹⁶² Nickles, *Under the Wire*, p. 33.

Ottoman Empire.¹⁶³ With business, news, and diplomatic exchanges competing for bandwidth along the same wires, however, there were only so many messages which could be transmitted. As traffic began to jam the rather limited lines traversing the European continent, state and society engaged in a battle over time.

The effects of this struggle were felt and expressed most acutely by those circles which depended upon regularity in communication, and saw this interrupted. When the *Pfälzer Zeitung* and the *Nürnberger Correspondent* reached an agreement to exchange telegraphic news reports, *Telegraphen-Direktor* Dyck explained that their connection would suffer a significant delay. It was caused ‘by the extraordinary piling up of telegraphic correspondence, due to political circumstances, not only from the government but also private telegrams on the line from Vienna, through Munich [...] to Paris’ which amounted to, on average, 200 throughout each day and night.¹⁶⁴ Around the same time, the Frankfurt *Handelskammer* complained that news of the Vienna exchange rates were arriving late, as did the *Landshuter Zeitung*. Once again, Dyck explained, this was due to the extraordinarily intense use of the Munich-Vienna line ‘upon which at this time the entire oriental correspondence to France and England, and vice versa to the Orient, is moving at a rate of a few hundred telegrams a day’.¹⁶⁵

Friction between the administration and its principal customers derived not only from the inconvenience of the delays they suffered, but also the temporal hierarchy which it established between state and private correspondence. According to the regulations, Dyck explained, state telegrams were prioritised, and ‘private telegrams

¹⁶³ R. H. Davison, ‘The Advent of the Electric Telegraph in the Ottoman Empire’, in R. H. Davison (ed.), *Essays in Ottoman and Turkish History, 1774-1923: The Impact of the West* (London, 1990), pp. 133-65.

¹⁶⁴ BHStA, GDVA 673, Dyck to Redaktion der Pfälzer Zeitung, 9 Apr. 1854.

¹⁶⁵ BHStA, GDVA 673, Handelskammer Frankfurt to Telegraphen-Direction München, 30 Mar. 1855; BHStA, GDVA 673, Dyck to Redaktion der Landshuter Zeitung, 30 Sep. 1855.

[would] be sent according to the order in which they have been handed over'.¹⁶⁶ Telegrams were handled sequentially, according to the neutral standard of time, but when traffic overburdened the lines, the priority given to government and administrative correspondence was translated into a temporal advantage.

These issues were not unique to Bavaria. In 1861, in response to the Prussian government's recent reduction in tariffs, the *Neue Frankfurter Zeitung* produced an article criticising the way in which these temporal hierarchies were being managed. In a text which echoes the terms of current debates on 'network neutrality', the newspaper complained that however cheap the use of the telegraph may have become, the fact that two thirds of correspondence came with a note stating 'delayed due to accumulation' was unacceptable. Time and promptness were more important for the principal users of the technology, the article insisted, and 'if [a telegram] arrives in the hands of the addressee too late, then it is too expensive [even] if it only costs one Kreuzer; if it is handed over to the addressee quickly, then it often has great value'.¹⁶⁷

According to the *Neue Frankfurter Zeitung*, to simply reduce the cost of the telegraph service was to dismiss its different functions. Since 1859, it reported, increases in use of the telegraph had been registered at 92% for financial news, 33% for commercial telegrams, 65% for newspaper reports and only 21% for family news. This increase, however, had not been matched by an improvement in Prussian infrastructure. Cost was of secondary importance to 'those who use the telegraph most [...] namely the commercial estate and newspaper editors', the author insisted, and they should be given the option of paying more to ensure the priority of their correspondence.¹⁶⁸

¹⁶⁶ BHStA, GDVA 673, Dyck to Redaktion der Pfälzer Zeitung, 9 Apr. 1854.

¹⁶⁷ BHStA, GDVA 674, *Neue Frankfurter Zeitung*, 25 Jul. 1861.

¹⁶⁸ *ibid.*

‘If it is already the case that, for our Berlin correspondent, barely 15 of the telegrams deposited here reach the stock exchange in Berlin on time’, the article continued, ‘then it is unjust to increase the number of useless telegrams being sent by reducing the tariff’.¹⁶⁹ As the newspaper made clear, lowering the cost of telegraphing would encourage its practice among those for whom cost was the main concern, and thereby further burden the network. For the principal users of the telegraph, however, the time gained by using the telegraph, rather than the money spent upon a telegram, was of greater value.

In this way, both within and across states, the telegraph network distinguished between included and excluded localities, between those tuned in to a faster pace of life, and those left behind. Already, however, the limited ‘bandwidth’ available had begun to interfere with relations even among those connected to the network, not only towns and villages, but states too. The archives are replete with examples of attempts by the telegraph administration to discern the true source of delays, tracing their origin back throughout Europe.¹⁷⁰ Blame for these disruptions was passed from one state administration to another, as the material deficiencies of different lines came to impact individuals’ and governments’ relations with one another.

Behind the scenes, meanwhile, stood the cast of innovators and entrepreneurs whose fortunes fluctuated with the initiatives of governments to extend or limit their networks. In Prussia, for instance, Werner Siemens’ involvement in constructing the state’s network was brought to an abrupt end in 1851 when he was accused of providing faulty installations. Before long, however, his luck had turned again, when the Crimean

¹⁶⁹ BHStA, GDVA 674, *Neue Frankfurter Zeitung*, 25 Jul. 1861.

¹⁷⁰ See, for example, BHStA, GDVA 680, Directeur général de l’administration des lignes télégraphiques to Telegraphenamt, 10 Oct. 1854; BHStA, GDVA 680, Dyck to KK General-Direction der Communication, 30 Mar. 1853. Many more examples are located in: BHStA GDVA 680, 682, 683, 684.

War spurred the development of a Russian network and the Tsar's government turned to the German entrepreneur, and his brother Carl, for help.¹⁷¹

The concerns of these engineer-entrepreneurs reflected the changing needs and expectations of the telegraph network's users. From 1854, the *Zeitschrift des Deutsch-Österreichischen Telegraphen-Vereins* took over from *Dinglers* as the principal forum in which to discuss the progress of the technology, and to link it to the concrete concerns of the different German telegraph administrations. In technical terms, relays, insulation and duplexing methods were developed to ensure that the greater distances being covered by Europe's expanding networks could provide the reliable and uninterrupted service which was now expected.¹⁷²

By 1860, there were already 7,270 km of telegraph lines in Prussia, 12,822 km in Austria-Hungary, 2,030 in Bavaria, and 1,023 km in Saxony.¹⁷³ The same year, around 250,000 telegrams were sent within the territories of northern Germany,* almost 500,000 in Austria-Hungary, 100,000 in Bavaria and 37, 000 in Württemberg.¹⁷⁴ Around 354,000 telegrams were sent and received in international correspondence in northern Germany, 222,000 in Austria-Hungary, 98,000 in Bavaria, and 37,000 in Württemberg.¹⁷⁵ The future, meanwhile, seemed to lay in the submarine cables being laid across the Mediterranean, as a first (unsuccessful) attempt to establish a trans-

¹⁷¹ M. Lutz, *Carl von Siemens, 1829–1906: Ein Leben zwischen Familie und Weltfirma* (Munich, 2013), pp. 85-92; W. von Siemens, *Lebenserinnerungen*, ed. W. Feldenkirchen (Munich, 2008), p. 199.

¹⁷² V. Aschoff, *Geschichte der Nachrichtentechnik* (2 vols., Berlin, 1995), ii., 248-50; K. Beauchamp, *A History of Telegraphy* (London, 2001), p. 82.

¹⁷³ Reindl, *Der Deutsch-Österreichische Telegraphenverein*, pp. 262-5.

* According to the statistics of the International Telegraph Union, the heading 'Northern Germany' comprised the future states of the Kaiserreich of 1871, *excluding* Baden, Württemberg, and Bavaria.

¹⁷⁴ *Statistique générale de la télégraphie dans les différents pays de l'ancien continent* (Bern, 1871), pp. 26-7, 'ITU Historical Statistics', accessed 22 Mar. 2017, at <http://www.itu.int/en/history/Pages/HistoricalStatistics.aspx>.

¹⁷⁵ *ibid.*, pp. 32-3.

Atlantic connection was made in 1858.¹⁷⁶ The world's telegraphic communities were set to expand.

Conclusion: Karl Knies and the Materiality of Communication

Unlike Friedrich List and Robert von Mohl before him, when Karl Knies turned his attention to the socio-economic implications of telegraphy, he could draw upon the benefit of recent experience. One of his lesser known studies, *Der Telegraph als Verkehrsmittel*, was written in 1857, at a time when both parliament and government appeared increasingly to adhere to the 'classical' liberal economic principle that the purpose of communication was the free and unhindered interaction of individuals. By investigating the technology, Knies reflected a widespread interest among contemporary intellectuals in examining the foundations of such principles. Taking into account the material realities of communication, however, he highlighted the direction in which political, social and economic thought were heading.

Karl Knies is generally associated with the 'older' Historical School of economics, which included Wilhelm Roscher and Bruno Hildebrand, and is seen as establishing a German tradition which diverged from 'Western' political economy.¹⁷⁷ The school's origins are commonly dated to the publication of Roscher's *Vorlesungen über die Staatswirtschaft* in 1843, in which the universal laws of economic exchange underpinning British and French models appeared to be rejected, in favour of an inquiry into the historical evolution of individual societies.¹⁷⁸ Knies' better known work, *Die politische Ökonomie vom Standpunkt der geschichtlichen Methode* (1853), was clearly a

¹⁷⁶ *Statistique générale de la télégraphie* (1871), pp. 74-5.

¹⁷⁷ Y. Shionoya, *The Soul of the Historical School: Methodological Essays on Schmoller, Weber and Schumpeter* (Boston, 2005), p. 1.

¹⁷⁸ K. Tribe, *Governing Economy: The Reformation of German Economic Discourse, 1750-1840* (Cambridge, 1988), p. 205.

contribution to the elaboration of such an approach, which is then seen as laying the foundations for Germany's peculiar brand of economic, and eventually, social thought.¹⁷⁹

The grouping of these thinkers under the umbrella term of the 'Historical School', however, not only misrepresents the loose ties between them, but also obscures their engagement with the intellectual environment in which they operated.¹⁸⁰ Since the 1840s, the tenets of the 'classical' economics derived from Adam Smith had been placed under increasing scrutiny from different perspectives. In 1841, Friedrich List's *Der nationale System der politischen Ökonomie*, had famously denounced the cosmopolitanism which derived from Smith's approach for failing to acknowledge the primacy of nations as constitutive of humanity. Others such as Hildebrand, Lorenz Stein, and of course Karl Marx, had turned their attention to the 'social question', and begun to question the natural order which was supposed to derive from the 'invisible hand' of the free market.¹⁸¹

Despite these critiques, however, the principal foundation of Smithian economics was in fact widely accepted, namely that the satisfaction of the individual's material needs by means of exchange was fundamentally constitutive of an autonomous realm of economic interaction. Indeed, this principle had become a core component of German *Nationalökonomie* since the 1820s, in the works of Heinrich Rau and J.F.E. Lotz, for instance.¹⁸² As Keith Tribe has argued, however, these authors had sought to integrate Smith's individualism within an enduring Cameralist framework of

¹⁷⁹ G. Stavenhagen, *Geschichte der Wirtschaftstheorie* (Göttingen, 1969), p. 196.

¹⁸⁰ D. Lindenfeld, *The Practical Imagination: The German Sciences of State in the Nineteenth Century* (Chicago, 1997), p. 152 ; Erik Grimmer-Solem has raised a similar criticism against the description of the 'younger Historical School', in *The Rise of Historical Economics and Social Reform in Germany, 1864-1894* (Oxford, 2003), pp. 19-34.

¹⁸¹ Lindenfeld, *Practical Imagination*, p. 180-5.

¹⁸² See Introduction, p. 18.

administration and *Polizei*, tailoring the blend to the needs of each state. By the 1850s, therefore, it was not the foundations, but the ramifications of ‘classical’ economics which were increasingly called into question.¹⁸³

What Roscher had called for in 1843, in fact, was not a jettisoning of Smith’s ideas, but a more thoroughgoing inquiry into its details, working upwards from the individual to the universal laws of economic interaction which Smith appeared to have identified.¹⁸⁴ It was not the individualism of Smith *per se* which Hildebrand and Knies denounced around this time, but rather the ‘egoism’ with which it was associated.¹⁸⁵ For this reason, in 1851 Robert von Mohl called for the establishment of a science of society, so as to explore the product of economic relations. Society, he believed, was the natural buffer between the state and the ‘individualistic impulses at work in the economy’.¹⁸⁶

It is within this context that Knies turned his attention to the telegraph. Economic life, he believed, was driven by the human desire to satisfy material needs, and the social interactions through which this was achieved: ‘[T]o live actively is nothing other than to live in intercourse (*im Verkehr leben*)’, he wrote.¹⁸⁷ Knies had therefore chosen to focus upon communication as the fundamental force of economic life, but rather than take its implications for granted, as Smith was seen to have done, he understood that it was crucial to investigate the concrete means by which it was achieved. Knies had already begun this work in 1853, when he had published *Die Eisenbahnen und ihre Wirkungen*.¹⁸⁸

¹⁸³ Tribe, *Governing Economy*, pp. 183-202.

¹⁸⁴ Stavenhagen, *Geschichte der Wirtschaftstheorie*, p. 195.

¹⁸⁵ Tribe, *Governing Economy*, p. 150.

¹⁸⁶ J. Sheehan, *German Liberalism in the Nineteenth Century* (London, 1978), p. 87.

¹⁸⁷ Knies, *Der Telegraph*, p. 1

¹⁸⁸ K. Knies, *Die Eisenbahnen und ihre Wirkungen* (Braunschweig, 1853).

In *Der Telegraph als Verkehrsmittel*, therefore, he inserted the technology in the long line of tools which had served man's need to communicate. The product of such interaction, he emphasised, was not purely economic, moreover. 'Is the spiritual, the ethical need for communication weaker than the economic?', he asked.¹⁸⁹ In this sense, he shared with Marx the belief that ideas, the 'spiritual' life of individuals, was intimately related to their material, economic interactions.¹⁹⁰ Knies did not therefore see the telegraph as a game-changing technology, but rather as a catalyst for an existing process of social transformation. Newspapers, and *Annoncen*, in his view, had already contributed to this process by enabling the widespread distribution of information across an increasingly literate society. Latent needs for communication were being thereby released, enabling populations to share in a 'common destiny'.¹⁹¹

The telegraph, as Knies understood it, could not fundamentally revolutionise this form of communication because of its 'weak aspects'. 'The telegraph is a winged messenger equipped with the speed of lightning', he wrote, 'but he only ever bears one letter'.¹⁹² Whereas trains could carry bundles of letters at once, each telegraph wire could only bear a limited load, and transmit messages sequentially. This was but one among many acknowledgments of the technology's limitations.¹⁹³ As a result, Knies believed that '[o]nly time-sensitive, important messages can and should be sent by telegraph. It is not the means of transport for extended discussion of sentimental

¹⁸⁹ Knies, *Der Telegraph*, p. 3.

¹⁹⁰ H. Hardt, *Social Theories of the Press: Constituents of Communication Research, 1840s to 1920s*, 2nd edn. (Lanham, 2001), p. 23.

¹⁹¹ Knies, *Der Telegraph*, p. 63.

¹⁹² *ibid.*, pp. 206-7.

¹⁹³ *ibid.*, pp. 206, 212.

outpourings (*gemüthlichen Ergießungen*)'. For the latter, the letter remained the best medium.¹⁹⁴

It was in the very nature of telegraphic communication, therefore, that it should primarily be used for commercial purposes. Yet like his contemporaries, Knies was eager to avoid the dual pitfalls of 'egoism' on the one hand, and of class domination on the other. He sought a means of balancing the somewhat exclusive nature of the technology with his belief that communication should serve a broader purpose. If it could only transport individual messages, telegraphy was therefore at its best, he explained, when it transmitted telegrams of 'general interest', which could then be reproduced and distributed more widely – in the press, for instance. In this respect, Knies was echoing Friedrich List's assertion, twenty years earlier, that the telegraph would provide news of utility to the '*intérêt général*' and the '*chose publique*', which should be published for the benefit of all.¹⁹⁵

Whereas List believed the government should assume responsibility for doing so, however, Knies believed the best means of sharing useful news was by means of 'associative consumption'.¹⁹⁶ Removing the state from the equation, he preferred to promote the practice of group subscriptions to news, as a healthy means of spreading the cost of telegrams and maximising the utility of each individual message.¹⁹⁷ In promoting this means of 'consumption', Knies was drawing upon the theme of association which was seen by other writers and indeed politicians as a crucial social intermediary between the individual and the state.¹⁹⁸ The technical constraints which he had identified in the technology – namely, its inability to transmit multiple messages at

¹⁹⁴ Knies, *Der Telegraph*, p. 208.

¹⁹⁵ See Chapter One, pp. 50-1.

¹⁹⁶ Knies, *Der Telegraph*, p. 215.

¹⁹⁷ *ibid.* p. 215

¹⁹⁸ Lindenfeld, *Practical Imagination*, p. 182.

once – had thereby been turned into a means of reinforcing the community of ‘common destiny’ which he saw as central to social evolution.

It is with these material limitations of the technology in mind, therefore, that Knies was able to conceive of a state telegraph network as the ‘nerves’ of the ‘*Staatskörper*’, perhaps his most famous formulation.¹⁹⁹ In doing so, he drew upon a discourse of nervous stimulation derived from the emerging discipline of organic physics, or physiology, propounded by academics such as Hermann Helmholtz, who had himself closely followed the development of telegraphy.²⁰⁰ He also thereby contributed to the diffusion of an organic metaphor which many intellectuals were using as a means to reconcile the individual, society and the state as a system of interdependent organs.²⁰¹

Crucially, however, Knies used the analogy with nerves to emphasise that the network would not simply foster communication between all individuals – as it was technically unfeasible to do so - but instead distribute identical information to and – crucially – from, every nerve ending, enhancing the sense of commonality within a nation. As the telegraph served to satisfy a natural human propensity to communicate, and could be used to enhance the feeling of a ‘community of destiny’ within society, Knies limited the role of the state to creating the parameters in which this communication could take place.²⁰²

Knies’ work thus provides an exemplary illustration of the convergence of economic, political and social thought upon the idea and material reality of communication during this period. The 1850s had witnessed the emancipation of the

¹⁹⁹ Knies, *Der Telegraph*, pp. 243-4.

²⁰⁰ L. Otis, *Networking: Communicating with Bodies and Machines in the Nineteenth Century* (Ann Arbor, 2001), pp. 11-48.

²⁰¹ Lindenfeld, *Practical Imagination*, pp. 176-80.

²⁰² Knies, *Der Telegraph*, p. 247.

means of economic exchange from the aims of the state. Under pressure from liberal principles, governments had been forced to relinquish the notion that telegraph networks might provide fiscal advantages, and to place them at the disposal of commercial centres across their territories. Whilst state and economy had thus been distinguished in theory, however, the network had begun to sharpen the distinctions between those privileged with access to the service and those excluded from its reach. Moreover, it had slowly become apparent that users communicating for different purposes were placing increasing pressure on the network. The state's own administrative organs, as well as individuals not engaged in economic exchanges, were wrestling for access to a service limited by technical constraints.

Communication and exchange, the central forces of classical economic theory, therefore, appeared to be emphasising rather than erasing social distinctions. Sharing his contemporaries' concerns for the fraught relationship between the individual, the collective, and the state, Knies sought to turn the technology's limitations to its advantage, as a means of increasing the sense of 'common destiny' among its users. In the process, he demonstrated that the *means* of communication were intimately connected not only to economic but also social life. By focusing upon the materiality of the abstract forces of economic theory, he had helped lay the foundations of an emerging study of society, foreshadowing the concerns which would emerge in the 1860s for the broader purposes of communication.

Chapter Five: Staying Ahead, Falling Behind

At 6.40 am on 13 April 1859, a telegram was received at the railway station office in Augsburg, addressed to Ernst Freiherr von Lerchenfeld, *Regierungspräsident* for the region of Schwaben and Neuburg: ‘His Majesty wishes that you present yourself upon his passage through the station, exceptionally in civilian dress, for a brief discussion’.¹ The king was due to arrive at 7.35 am, so time was pressing.² At 6.48 am, the telegram was handed over to the messenger who was to deliver it to Lerchenfeld’s home, 1.6 kilometres away in town. He arrived twenty minutes later, but was unable to hand the message to the *Regierungspräsident* personally and waited a further ten minutes before the delivery confirmation slip was returned to him, signed by another person, and indicating an approximate time of receipt.³ It was now around 7.20 am, and only fifteen minutes remained before the king was due to arrive at the railway station on the outskirts of town.

It is unclear who warned Lerchenfeld directly of the king’s imminent arrival and at what time, but he was able to make the appointment. Indeed, the monarch’s train was late. Returning home after his meeting, Lerchenfeld was appalled to find that the telegram announcing the visit had supposedly been delivered to his home at 7.30. Had the king arrived as planned, he later complained, he would barely have reached the station in time, and ‘would have appeared negligent in the eyes of His Majesty, and disobedient to his orders’. This was not the first incident of the kind, he added; telegrams were often delivered at least an hour after their arrival at the telegraph office.

¹ BHStA GDVA 680, Telegram from Munich to Augsburg, 13 Apr. 1859.

² BHStA GDVA 680, Lerchenfeld to Oberpostmeister, 13 Apr. 1859.

³ BHStA GDVA 680, Telegraphen-Station Augsburg to Telegraphenamt, 26 Apr. 1859.

In future, such urgent messages would have to be delivered immediately, a service for which he was willing to pay any delivery fee which might be applied.⁴

This minor incident in Augsburg illustrates the precise temporal coordination of activities which the telegraph facilitated, but also the greater sensitivity to delays which was generated as a result. During the 1860s, the telegraph network came to support a growing number of such activities, as the production sector became tied to the fluctuations of market capitalism and manufacturers came to join bankers, merchants, news agents, and administrators as its primary customers. In doing so, it highlighted the consequences of the economic transformations in which they were participating.

The 1850s had witnessed the rising confidence of the capitalist and industrial *Wirtschaftsbürgertum* and its political counterpart in the liberal movement across Germany. The *Nationalverein* established in 1859 testified to this confidence, and in both Prussia and Bavaria the decade culminated in constitutional crises pitting a liberal parliament against the government. The confrontation in Prussia resulted in the appointment of Bismarck as minister-president, whereas in Bavaria the chief minister Ludwig von der Pfordten was dismissed, and a new cabinet installed which was more attuned to the wishes of the *Landtag*, under the leadership of Karl von Schrenck.⁵

Whether it was reluctantly accommodated or overtly combatted, the predominance of the business sector in fuelling German states' economies was now recognised. The 1850s had marked the beginning of industrial 'take-off' in Germany as a whole, driven by new service and production sectors. The metallurgical industry, the concentration of textile production in manufactures and, eventually, factories, along

⁴ BHStA GDVA 680, Lerchenfeld to Oberpostmeister, 13 Apr. 1859.

⁵ H. Rall, 'Die politische Entwicklung von 1848 bis zur Reichsgründung 1871', in M. Spindler (ed.), *Handbuch der Bayerischen Geschichte* (4 vols., Munich, 1967-75), iv./1, p. 245.

with the banking sector and an increasingly integrated national and European securities market displaced traditional structures of artisanal production as sources of economic growth rather than stability.⁶

Even in Bavaria, whose economy relied upon a combination of agriculture and textile production, a ‘diminished industrialisation’ was able to take hold, as spinning and weaving were mechanised, guild restrictions untightened, and capital was invested in heavy industry.⁷ When King Maximilian II asked his advisers ‘upon which classes to establish oneself?’, some respondents praised, others regretted, but all acknowledged the importance of the bourgeoisie. Before his departure in 1859, Ludwig von der Pfordten conceded that the ‘*Bürgerstand*’ of large urban areas was now at the heart of state life, and that priority should be given to manufacturing, trade, and municipal self-government.⁸

Over the course of the 1850s, the government had come to accept that telegraphy primarily served the needs of this emerging middle-class, and had shaped the network accordingly to the benefit of its economic centres, particularly the western commercial heartland. As its utility to broader sections of the *Wirtschaftsbürgertum* dispersed across the rest of the country became clear, however, prioritising particular towns or regions became problematic. Extending liberal principles, during the 1860s both government and parliament in Bavaria adhered to the principle that the state should limit its intervention to the provision of a communications infrastructure supporting economic exchange across the state in its entirety. To that end, two laws were enacted in Bavaria,

⁶ H.-U. Wehler, *Deutsche Gesellschaftsgeschichte* (5 vols., Munich), iii., 66-97.

⁷ K. Bosl, ‘Die “geminderte” Industrialisierung in Bayern’, in C. Grimm (ed.), *Aufbruch ins Industriezeitalter* (3 vols., Munich, 1985), i., 22-39.

⁸ M. Hanisch, *Für Fürst und Vaterland: Legitimitätsstiftung in Bayern zwischen Revolution 1848 und deutscher Einheit* (Munich, 1991), pp. 124-6.

in 1861 and 1868, which sought to redress the imbalances which had emerged since the beginning of the network's construction, and to create a ubiquitous service.

Similar developments were taking place across Germany and beyond. Throughout the *Deutsch-Österreichischer Telegraphen-Verein*, new lines were built before any wires were added to most existing connections - greater geographical network coverage was prioritised over improved performance. Across Western Europe, this was the era of 'secondary branches' in both telegraphy and railway construction. Not only in Germany and France, where government policy determined the direction and purpose of communications infrastructure, but in Britain too. There, the 1868/9 Telegraph Acts brought an end to the era of private competition, on the understanding that national and economic interests could be mutually-sustaining.⁹

The tumultuous geo-political re-alignments which marked this decade of German unification also provided renewed impetus for technological innovation. In particular, the conflicts of 1864 in Schleswig-Holstein and the Austro-Prussian war of 1866 supported the development of military applications of the technology. The shifts in alliances which took place as a result of these conflicts also impacted network arrangements between states but the necessity of cooperation often surpassed these geo-political antagonisms.¹⁰

Managing the flow of information throughout a now theoretically ubiquitous network involved new concepts of coordination. An 'organic' understanding of the network came to distinguish between larger and smaller 'hubs' of activity, and allowed for fluctuations in traffic between them. The inclusion and exclusion which had taken

⁹ S. Fari, *Victorian Telegraphy before Nationalization* (Basingstoke, 2015), pp. 161-204.

¹⁰ J. Reindl, *Der Deutsch-Österreichische Telegraphenverein und die Entwicklung des deutschen Telegraphenwesens, 1850-1871* (Frankfurt am Main, 1993), p. 197.

place during the 1850s, and the ‘de-synchronisation’ which it had caused, were now followed by a process of ‘synchronisation’ between the vast array of newly connected nodes. Across the network, time was to be homogeneous, providing the yardstick against which all town and village offices could coordinate their exchanges.

As a result, however, greater time-sensitivity was introduced into relations between the individuals and municipalities now connected throughout the state. As all users came to depend upon one and the same network, temporal hierarchies emerged when certain places were afforded more direct, rapid connections than their neighbours, pushing ‘ahead’ as others fell ‘behind’. Growing interdependence also meant growing competition, therefore, and whilst the telegraph supported the bourgeoisie’s ‘silent revolution’ across Germany, it also heightened tensions within it.¹¹

Not only between, but within towns too, establishing telegraph offices in particular locations placed some users at a strategic advantage over others. The technology introduced a foreign element into the structures of local life, marking the infiltration of communities by both the state and the socio-economic forces driving its ‘movers and doers’.¹² But it also revealed the different directions in which this very same rising social stratum was being pulled by the forces of capitalism and industrialisation, not least as a consequence of the telegraph itself.

¹¹ D. Blackbourn, ‘The Discreet Charm of the Bourgeoisie: Reappraising German History in the Nineteenth Century’, in D. Blackbourn and G. Eley, *The Peculiarities of German History: Bourgeois Society and Politics in Nineteenth-Century Germany* (Oxford, 1984), pp. 176-205. On the diversity inherent in the concept of the ‘bourgeoisie’ in the historiography of Germany, see M. Hettling, ‘Eine anstrengende Affäre: Die Sozialgeschichte und das Bürgertum’, in S. O. Müller and C. Torp (eds.), *Das Deutsche Kaiserreich in der Kontroverse* (Göttingen, 2009), pp. 219-33.

¹² M. Walker, *German Hometowns: Community, State, and General Estate, 1648-1871* (Ithaca, 1971), pp. 119-33.

Visions of Communication: The Economic Imperative

During the 1850s, attempts to find economical ways of expanding the Bavarian telegraph network had revealed crucial deficiencies. In particular, the decision to open railway telegraph lines to private correspondence had only had a limited effect. The measure had been imposed upon state railways, but negotiations to introduce the policy on private lines had been in vain. Yet it was those very regions which had been excluded from the initial network outline, those which lay outside the commercial and manufacturing heartland of the state, which were most severely affected. Neither of the two private companies in the Pfalz, nor the Ostbahn-Gesellschaft serving the eastern parts of Bavaria, had acceded to the government's wishes on this point. As a result, many towns in Niederbayern, Oberpfalz and the Pfalz remained excluded from the telegraph network.

Repeated requests from regional authorities, from the *Handelskammern*, and finally from parliament itself, caused the government to take action. In February 1861, the issue was raised in the *Kammer der Abgeordneten*, where criticisms of the state's inaction were heard. The liberal deputy Franz Peter Buhl, supporter of the *Pfälzischer Kurier*, asserted that 'Bavaria takes the first rank among those countries which has done the very least for an institute which is of the greatest significance for the development of state-economic relations'.¹³

Indeed, despite an initial flurry of activity, the 1850s had been marked by a reluctance on the part of government and parliament to invest any further in communications infrastructure – the state-funded *Ostbahn*, for instance, had been

¹³ VKA (1859/61), 7 Feb. 1861, p. 115.

privatised.¹⁴ In fact, as the case-handler for the *Kammer der Abgeordneten* pointed out, the deputies themselves had pressed the telegraph administration to prioritise the profitability of the network at that time, so as to avoid a tax hike.¹⁵ The possibility of some private involvement was now once again evoked, but the majority opinion had moved in the opposite direction.¹⁶

The government was fully aware that the measures taken in the 1850s had been insufficient. Within a day of the parliamentary debate, the *General-Direktion der Verkehrsanstalten* produced a new cost projection for the works it felt should be carried out, and a month later a bill was produced before the *Staatsrat*.¹⁷ The new liberal minister-president, Karl von Schrenck, proposed constructing a number of specific lines which would extend the service across the hinterland of the Pfalz to the west, and through the no man's land between Amberg and the border with Bohemia to the east. These lines, Schrenk explained, had been chosen so as to plug 'the remaining gaps in particular parts of the country'.¹⁸ The king himself supported the extension of the service to manufactures too, and though there was little evidence that they would make any use of it, it was acknowledged that conditions might change and render this necessary.¹⁹

The proposal signalled an explicit change in government policy, setting aside profitability in favour of national economic interests across the state. The distinction had been made in parliament, by the deputy Ludwig Römmich: 'Private companies must question whether the undertaking produces a profit', he stated, 'but the state has

¹⁴ D. Götschmann, *Wirtschaftsgeschichte Bayerns: 19. und 20. Jahrhundert* (Regensburg, 2010), p. 110.

¹⁵ VKA (1859/61), 7 Feb. 1861, p. 117.

¹⁶ *ibid.*, p. 116.

¹⁷ BHStA, GDVA 227, 'Nachtrag zum Kostenvoranschlag über Ergänzung des Telegraphen-Netzes', 8 Feb. 1861; BHStA, Staatsrat, 1076, 'Protokoll der Sitzung des Staatsrats', 8 Mar. 1861.

¹⁸ BHStA, Staatsrat, 1076, 'Protokoll der Sitzung des Staatsrats', 8 Mar. 1861.

¹⁹ *ibid.*

the duty to cater to every economic need, even if the revenue doesn't correspond entirely to the expense, or if a profit from the revenue is not to be expected'.²⁰ Government finances were in no better shape in the 1860s than a decade earlier, but the expectations placed upon the state - notwithstanding the traditional objections of deputies such as Gustav von Lerchenfeld - were beginning to gain ground.

Discussion of the bill in the two chambers of parliament highlighted the insatiable appetite of the country for the new technology. As the case-handler for the *Kammer der Reichsräte* asserted, '[a]lmost every day, we read petitions for new railway lines; the desire for telegraph lines is equally vivid, perhaps even greater, as the costs of construction are smaller, and every individual would like to have the telegraph as close as possible to his house'.²¹

Indeed, the number of requests from towns which made their way into parliament was much higher than in the 1850s. Sankt Ingbert, Kusel, Bergzabern, Frankenthal, Pirmasens and Dillingen, from the neglected region of the Pfalz, were evoked in parliament, as well as Vilshofen and Neuburg along the Danube near Passau, which were outside the state's most productive regions.²² During the following years, ever smaller localities began to put forward their requests for a telegraph connection. By the end of the decade, the accusation that to support requests from such towns was to defend mere parochial interests (*Kirchthurmsinteressen*) was no longer raised in parliament.²³

The 1861 bill was intended to 'complete' the network, but already it signalled broader ambitions. It provided, among other things, for lines in the Pfalz from Speyer to

²⁰ VKA (1859/61), 7 Feb. 1861, p. 116.

²¹ VKA (1859/61), 19 Jun. 1861, p. 467.

²² VKA (1859/61), 29 Apr. 1861, p. 348-60.

²³ VKA (1859/61), 29 Apr. 1861, p. 357.

the Prussian border in Saarbrücken, and connections to Pirmasens and Dürkheim. In Bavaria proper, it satisfied the repeated requests of Marktbreit and Kitzingen near Würzburg, and projected lines leading eastward from Nuremberg, to Amberg and the border with Bohemia.²⁴

If government policy was now to avoid rejecting the multiplying demands from its towns and villages, however, new logistical solutions were required to manage them. King Maximilian had suggested using railway and post personnel to run the telegraph service in small localities as a cost-saving measure, and the proposal was brought up in the *Kammer der Abgeordneten*.²⁵ To combine postal and telegraph services in particular, the case-handler explained, would avoid incurring the cost of establishing an independent telegraph office in very small localities, whose usage would not cover the expense. If this had been achieved in Baden, Neuffer asked, why not in Bavaria too?²⁶ The practice was introduced across the *Deutsch-Österreichischer Telegraphen-Verein*, and by 1867 in Prussia 70% of all offices provided a combined post and telegraph service.²⁷

Traditional opponents to increased state intervention held firm in their demand for a restriction of spending. Lerchenfeld pointed to recent statistics which continued to suggest that few telegraph offices were handling enough telegrams on a daily basis to justify their employment of personnel. He also insisted that to compare Bavaria with neighbouring states was futile, as their demographic composition was considerably different, and because countries such as England, France, Baden and Switzerland had often benefitted from much more enthusiastic uptake of the service. So long as the

²⁴ BHStA, Staatsrat, 1076, 'Protokoll der Sitzung des Staatsrats', 8 Mar. 1861.

²⁵ *ibid.*

²⁶ VKA (1859/61), Beilage XLVII, 8 Apr. 1861, p. 516.

²⁷ Reindl, *Der Deutsch-Österreichischer Telegraphenverein*, pp. 132-4.

telegraph network was not reporting a profit, he believed, those parts of the country which did not possess a connection were simply paying to improve the service of those to whom it was most beneficial.²⁸

Lerchenfeld's frustration, however, was increasingly drowned out by the voices arguing that profitability was to be side-lined, and that the ubiquity of telegraphy was a necessity. It was now clear to all concerned that demand would continue to increase whilst providing little financial gain. The circle of regular users was gradually expanding and, crucially, diversifying. When Eduard Lang stood to defend his petition for a telegraph office in St Ingbert in the Pfalz, he identified three categories of customers. The first, which he viewed somewhat cynically, comprised traders of government bonds and stocks. The second encompassed those engaged in the trading of fruit and agricultural products, who needed prompt updates on price fluctuations. The third was composed of industrialists: production, Lang emphasised, also entailed distribution, and therefore trade.²⁹

Gustav von Schlör, a liberal deputy who sat on the board of directors for the *Ostbahn*, put the issue before the assembly: 'It is principally to be asked in this matter whether, on the one hand, a consideration of the general need, or on the other hand the possibility of financial success justifies the bill in question'.³⁰ The 'general need' or 'common good' had thus come into play, explicitly distinguished from state fiscal considerations, and implicitly associated with economic activity instead. As another deputy stated, 'as long as the countryside does not participate in the telegraph network,

²⁸ VKA (1859/61), 29 Apr. 1861, p. 350.

²⁹ *ibid.*

³⁰ *ibid.*, p. 352.

this important contemporary invention has not become common property of the nation'.³¹

The amount requested by the government and agreed by parliament in 1861 was relatively limited, at 200,000 fl. Specific lines had been designated for construction, but by 1867 it had become clear that, once again, a more thoroughgoing reconfiguration of the network was to take place. As before, the system of external and internal pressures was at work. During the 1860s, for instance, it became clear that Bavaria's income from the *DÖTV* was in decline. As revenue from communication between and through the states of the union was divided according to the length of lines which each possessed, Bavaria's relative inactivity in the construction of new connections had financial consequences. For this reason, one of the principal external connections proposed in the 1861 bill had been an extension of the south-western line to Switzerland, which would avoid correspondence being diverted through Württemberg.

In the interim, moreover, the decisive military engagements of the 1860s had impacted the shape of the German network.³² The role of the technology in warfare had been clear from the outset: the equipment of Germany's *Bundesfestungen* with telegraph connections had been discussed in the 1850s, and in 1856 an order was issued in Prussia to introduce the technology in the army.³³ When the Prussian army was mobilised in 1859, mobile field telegraphs were also deployed, and their utility was simultaneously under consideration by the Bavarian army.³⁴ The technology was then used both during the war with Denmark in 1864 and during the Austro-Prussian war of 1866, when

³¹ VKA (1859/61), 29 Apr. 1861, p. 350.

³² BHStA, Staatsrat, 1148, 'Protokoll der Sitzung des Staatsrats', 12 Oct. 1867.

³³ BHStA, GDVA 285, Pfordten to Telegraphenamt, 6 Jun. 1855; H. A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland* (Wiesbaden, 1983), p. 180.

³⁴ S. Kaufmann, *Kommunikationstechnik und Kriegsführung 1815-1945: Stufen telemedialer Rüstung* (Munich, 1996), p. 87; BHStA, MH 16793, Kriegsministerium to HM, 12 Apr. 1859.

General Moltke deployed field telegraphs and used the existing network to coordinate troop movements from his headquarters in Berlin.³⁵

Of more lasting consequence was the outcome of the 1866 war, which ended in both a '*postalisches Königgrätz*' and a '*telegraphisches Königgrätz*'.³⁶ Although the DÖTV was maintained, the North German Confederation's telegraph administration absorbed the networks of Hanover, Hamburg, Hessen-Nassau, and Saxony - in Bremen, the future of the privately-owned *Bremer Telegraphen Verein* was in jeopardy.³⁷ In Bavaria too, the consequences of the conflict were tangible. A number of its northern telegraph stations were lost to Prussia, particularly those in Frankfurt am Main, Mainz, Worms, Darmstadt and Gotha - the income from Frankfurt, as a centre of finance, was sorely missed.³⁸

The director of the *General-Direktion der Verkehrsanstalten*, Heinrich von Gumbart, bemoaned Bavaria's poor planning in the years leading up to the Austro-Prussian conflict, and in April 1867 he prepared a report which was to form the basis of a bill presented by Gustav von Schlör, in his new function as Minister of Trade.³⁹ His presentation contained an in-depth analysis of the usage and performance of the existing network, and suggestions for its future shape. The differences between Gumbart's analysis and the argument then put forward by von Schlör hinted at a subtle change in policy.

The *General-Direktor* made it very clear that the telegraph still served a particular community: 'For the moment, it is not so much about making the telegraph accessible to

³⁵ Wessel, *Entwicklung des Nachrichtenwesens*, p. 182.

³⁶ S. Weichlein, *Nation und Region: Integrationsprozesse im Bismarckreich* (Düsseldorf, 2004), p. 108.

³⁷ Reindl, *Der Deutsch-Österreichischer Telegraphenverein*, 194-7.

³⁸ *Rückblick auf das erste Jahrhundert der Kgl. Bay. Staatspost (1.3.1808 bis 31.12.1908)*, ed. Kgl. Bay. Staatsministerium für Verkehrsangelegenheiten (Munich, 1911), p. 319.

³⁹ BHStA, MH 16799, Gumbart, 'Bericht, Erweiterung des bayerischen Telegraphen-Netzes betr.', 15 Apr. 1867.

a new stratum of the population, to provide numerous new correspondents for this means of communication, rather much more about providing that portion of the trading and industrious public which lives far from the railways, with the possibility of using the telegraph; to avoid that, in case of crises, this portion of the public be abnormally negatively affected; in one word, at least to contribute something to preventing the mercantile and industrial depopulation of entire regions'.⁴⁰ In many ways, Gumbart's formulation conformed to the Bavarian government's policy of progressive economic liberalisation, removing the barriers to growth on one hand, without unduly promoting industrialisation and urbanisation on the other hand.⁴¹

A few months later, however, the proposal put forward by the minister himself presented a rather different understanding of the network. 'Initially only serving individual strata of the population, besides the state itself', he asserted, 'the telegraph institute, due to the reduction in tariffs and the increase in the number of telegraph offices, has completely changed its original character; it has now become as indispensable a need to the exchanges of all circles as the postal service, whose most important complement it constitutes'.⁴² Preparing the 1867 bill had confirmed that commercial and industrial interests remained at the heart of the network's use, but these were concealed behind the vision of a universally accessible public service for which the state assumed responsibility.

Whether conceived of as a tool of the capitalist middle classes, or of society as a whole, the economic function of the network now trumped questions of profitability.

⁴⁰ BHStA, MH 16799, Gumbart, 'Bericht, Erweiterung des bayerischen Telegraphen-Netzes betr.', 15 Apr. 1867.

⁴¹ I. Burkhardt, *Das Verhältnis von Wirtschaft und Verwaltung in Bayern während der Anfänge der Industrialisierung (1834-1868)* (Berlin, 2001), pp. 200-8.

⁴² BHStA, 1148, 'Protokoll der Sitzung des Staatsrats', Beilage V, 'Motive zum Gesetzentwurf', 12 Oct. 1867.

‘From the financial standpoint’, Gumbart had explained, ‘an extension of the telegraph network for internal correspondence [...] would not be justifiable. But it must be taken into account that, given the importance which telegraphic traffic has already attained in the spreading of rapid temporary economic trends [...] there is a certain moral duty for the state, whose monopoly the telegraph is, to render this means of communication equally accessible to all countrymen’.⁴³ Echoing Gumbart’s terms, the bill prepared by the minister asserted that there was ‘a certain moral duty, to make this means of communication, with its deeply penetrating advantages, as accessible as possible to all areas of the country’.⁴⁴

As a result, the 1867/8 bill was especially ambitious. It called for an investment of 1.8 million fl, nine times the amount requested in 1861, towards the laying of new wires along existing lines, as well as the construction of new lines and stations for internal correspondence. No longer were specific places and regions named, as the committee for the *Kammer der Abgeordneten* stated that it was now ‘completely impossible, both for the committee and the chamber to designate all those places which should be drawn into the network’.⁴⁵ It did, however, severely restrict the amount allocated to the project to around 1.35 million Gulden, and granted the state the right to determine places which should be most immediately prioritised.⁴⁶

At heart now lay the belief that although some places would make little use of the technology, as Schlör explained, ‘a single such instance in a small location, for a

⁴³ BHStA, MH 16799, Gumbart, ‘Bericht, Erweiterung des bayerischen Telegraphen-Netzes betr.’, 15 Apr. 1867.

⁴⁴ BHStA, Staatsrat 1148, ‘Protokoll der Sitzung des Staatsrats’, Beilage V, ‘Motive zum Gesetzentwurf’, 12 Oct. 1867.

⁴⁵ VKA (1859/61), 13 Mar. 1868, p. 321.

⁴⁶ *ibid.*

person there, can have the most significance'.⁴⁷ Presaging the future of the telegraph, Schlör even emphasised that aside from economic applications, it might be used to warn of 'fire outbreaks, floods, ice-drifts and family events'.⁴⁸ Just as the introduction of Bavaria's new *Gewerbeordnung* and *Heimatrecht* law were being prepared, Schlör had pushed through liberal principles and taken them one step further, suggesting that the telegraph should perform not only economic, but social functions too.

The Organic Rhythms of Telegraphic Correspondence

The reports which Heinrich Gumbart had presented to Schlör in preparation for the 1867 bill included a number of statistical compilations which revealed fluctuations in traffic on the network, both spatially and temporally. In international correspondence, for instance, the number of telegrams sent from Bavaria was at its lowest, around 6,500 per month, between December and February, but at its busiest, between 8,500 and 11,000 in the periods March to June and August to October. The impact of these variations in volume on the speed of transmission was noticeable: whereas a telegram from Munich to Berlin would take an average of 81 minutes in January, this increased to 186 minutes in September; to Paris, the figures were 137 minutes and 354 minutes, respectively.⁴⁹

Similar variations occurred on a daily basis at the central office in Munich. A trickle of telegrams began to be handed in for transmission around 7am, the flow reaching its peak between 11am and 12pm, during which an average of 110 to 120 telegrams were handled, declining to around 24 at midnight, and a few more before

⁴⁷ BHStA, Staatsrat 1148, 'Protokoll der Sitzung des Staatsrats', Beilage V, 'Motive zum Gesetzentwurf', 12 Oct. 1867.

⁴⁸ *ibid.*

⁴⁹ BHStA, MH 16799, Gumbart, 'Bericht, Erweiterung des bayerischen Telegraphen-Netzes betr.', Beilage VI, 15 Apr. 1867.

dying out completely at 4am.⁵⁰ Telegraphic traffic, the administration and government could now observe, had a life-cycle of its own.

Moreover, the rhythms of traffic during the year, months and days were matched by a particular geographical distribution. Unlike the railways, Schlör argued, the telegraph tended to reinforce existing relations rather than create new ones.⁵¹ There were thus natural ‘hubs’ of activity, between which traffic was most intense, and smaller localities which would produce only infrequent and low-intensity exchanges. The intensity of transmissions varied from place to place and from hour to hour.

In order to deal with the growing demand for telegraph offices throughout the state, therefore, Gumbart, and Schlör referred to the ‘organic structure of the network’.⁵² If practically every town and village was eventually to be connected to the network, in order to avoid excessive delays distinctions would have to be made between the more or less heavily ‘trafficked’ lines. The central channels connecting the important ‘hubs’ of communication would be crossed by ‘transversal’ lines; smaller channels would link second-tier towns to those hubs; and ‘individual blood vessels’ would in turn connect those towns to the smallest localities.⁵³

Eventually, every town and village could thus potentially be contacted by telegraph. Every organ in the telegraphic body, so to speak, was connected to the vital flow of information circulating within it. But those places making only infrequent use of the service need not be placed along the ‘arteries’ between major towns, as to do so

⁵⁰ BHStA, MH 16799, Gumbart, ‘Bericht, Erweiterung des bayerischen Telegraphen-Netzes betr.’, Beilage VII.

⁵¹ BHStA, Staatsrat 1148, ‘Protokoll der Sitzung des Staatsrats’, Beilage V, ‘Motive zum Gesetzentwurf’, 12 Oct. 1867.

⁵² *ibid.*

⁵³ *ibid.*

would excessively ‘populate’ the line and limit its capacity, or bandwidth.⁵⁴ Those smaller locations needed fewer lines and wires to provide them with an adequate service. Some channels would experience a continuously amplified volume of traffic, while others would receive less traffic, less often.

The ‘nerves of the nation’ used by Knies in 1857 to describe the network had given way to a metaphor of blood circulation and fluctuation. Although it sustained the tradition of bodily metaphors which cut across science, politics, and culture as a means of interpreting technological changes, the shift was nonetheless significant.⁵⁵ Knies’ metaphor had implied that all parts of the network could receive, or ‘feel’, as well as send impulses simultaneously. A single stimulus would activate each and every nerve ending. The organic metaphor, on the other hand, accounted for the rhythmical and spatially variegated flow of information. It required the coordination, rather than mere connection, of heavily ‘trafficked’ arteries with the lesser veins of the telegraphic body. Knies’ model had been based on his understanding of the material limitations of the technology in the 1850s, and changes in the network which had taken place since had ‘fed back’ into that of Schlör and Gumbart.⁵⁶

To the process of exclusion and inclusion which had dominated the earliest stages of the network’s construction were now added the hopes and anxieties related to individuals’ and municipalities’ position within the telegraphic body. For towns which had already experienced the benefit of a telegraphic connection, the threat of relegation to a narrower channel of communication was a source of particular frustration. In 1864,

⁵⁴ BHStA, MH 16799, Gumbart, ‘Erinnrung zum Vortrag des Abgeordneten Stauffenberg’, 29 Feb. 1868.

⁵⁵ L. Otis, *Networking: Communicating with Bodies and Machines in the Nineteenth Century* (Ann Arbor, 2001), pp. 11-48; D. Lindenfeld, *The Practical Imagination: The German Sciences of State in the Nineteenth Century* (Chicago, 1997), pp. 176-80.

⁵⁶ A. Friedrich, ‘Metaphorical Anastomoses. The Concept of “Network” and its Origins in the Nineteenth Century’, in B. Neumann and A. Nünning (eds.), *Traveling Concepts for the Study of Culture* (Berlin, 2012), pp. 119-143.

the *Handelsrat* of Ansbach, one of the earliest towns to be connected to the network a decade earlier on the basis of its administrative significance, could now feel the comparative slowness of its communication, as its direct connection to Nuremberg, a commercial centre, had been disestablished.⁵⁷

The small town of Neumarkt complained that when it sought to send telegrams southwards both Regensburg and Nuremberg designated one another as the appropriate point of contact. ‘The office of Neumarkt must often fight for hours to send such a telegram’ as a result.⁵⁸ The effects felt by the public were, as usual, delays in the receipt and transmission of their correspondence, but their technical causes were clearly not always understood. A reader’s letter to the *Nürnberger Anzeiger*, from a businessman, complained of the 28 hours needed to send a message from Nuremberg to Pappenheim. ‘Though it may be, as I hear, that telegrams must pass through Munich (why?), such a delay is nonetheless neither to be explained, even less to be justified’.⁵⁹

The explanation provided in response to this reader’s complaint highlighted the complications involved in the coordination of traffic along the lines. As the local engineer explained, the telegram sent from Nuremberg had arrived in Munich at 6.30pm. This was too late, however, to ensure that the office in Pappenheim, to which it was addressed, would receive it before it closed for the day at 7pm. It had to wait until the next day before being sent from Munich, therefore, and arrived an hour or so after the opening of the office in Pappenheim at 9am.⁶⁰ Existing office opening hours, in other words, determined the times at which transmissions could be made.

⁵⁷ BHStA, GDVA 675, Handelsrat Ansbach to GDVA, 27 Dec. 1864.

⁵⁸ BHStA, GDVA 676, Telegraphen-Station Neumarkt to Telegraphenamts, 3 Oct. 1869.

⁵⁹ BHStA, GDVA 676, *Nürnberger Anzeiger*, 29 Jun. 1870.

⁶⁰ BHStA, GDVA 676, Notes, Ingenieur Saifert, 4 July 1870.

Synchronisation

Time, indeed, provided the crucial framework needed to manage the rhythms of telegraphic communication. Ensuring the network's 'organic' structure involved not only the coordination of its larger and smaller channels across space, it also required their management over time – they had to be 'synchronised'. As early as 1854, the regulations of the *DÖTV* had specified that 'in order to avoid irregularities which might result from digressions from the standard times (*mittleren Zeiten*) at the different offices, the clocks of all telegraph offices under one and the same government will be set to the standard time of the capital city of the state in question'.⁶¹ The telegraph network of each German state was to constitute a homogeneous time zone.

Telegraph offices, the railway stations they often helped to serve, and the connections between them now constituted spaces of communication set to a different temporal standard from the surrounding environment. The clock in the telegraph office in Fürth, for instance, was set to Munich time every morning, but differed from those in the city by a few minutes.⁶² When the *Allgemeine Zeitung* complained of repeated delays in the reception of telegrams in 1860, for instance, the head of the telegraph office in Augsburg explained away some of the reported incidents on the basis that 'the town clocks very often differ from the standard clock of the [telegraph] office and the railway station by five to ten minutes'.⁶³ The delays evoked by the newspaper editors' were often exaggerated as a result.

Within the space of telegraphic communication, a single 'standard time-orientation' existed, which allowed for the organisation of transmissions, but also the

⁶¹ *Zeitschrift des Deutsch-Österreichischen Telegraphen-Vereins*, 1 (1854), p. 5.

⁶² BHStA, GDVA 674, Telegraphen-Station Fürth to Telegraphenamt, 23 Dec. 1856.

⁶³ BHStA, GDVA 674, Telegraphen-Station Augsburg to Telegraphenamt, 26 Jan. 1860.

measurement of speed and delays.⁶⁴ On one hand, unlike railway travel, there were no fixed times at which telegrams were sent and received, and individuals were free to communicate as and when they pleased. The objective was not the simultaneous transmission and reception of each message across the network evoked by Knies, but the creation of a common structure, a frame of reference, using which individuals could coordinate their personal interactions as they chose. On the other hand, the ability of individuals to ‘schedule’ their use of the telegraph for social purposes was restricted by the boundaries of office opening times.

The time-sensitivity of the business transacted by the telegraph’s primary users was thereby both served and enhanced. Keeping up with the fluctuations of the market, for instance, required that news be sent and received within specific time-frames. The Munich *Handelsverein* insisted that it must receive telegrams from Vienna in time for the ‘*Börse*’ which it held between 10 and 11am and 5.30 and 6.30pm.⁶⁵ Businessmen could thus coordinate their transactions across extensive distances, but they also became dependent upon the technology. In 1869, for example, the Filialbank in Bamberg complained that stock prices from Frankfurt were arriving after 8pm, whereas the *Frankfurter Effecten Societät* (as the stock exchange was then known) processed its daily transactions between 6pm and 7pm.⁶⁶ The telegraph both raised expectations and sharpened disappointments in circles whose practices revolved around the management of time.

The potential availability of each office for communication at any time remained the ideal objective. If this was not the case, then messages handed in late might be

⁶⁴ Eviatar Zerubavel, ‘Timetables and Scheduling: On the Social Organization of Time’, *Sociological Inquiry*, 46, no. 2 (1976), p. 88.

⁶⁵ BHStA, GDVA 676, Vorstandschaft des Münchener Handelsvereines to Telegraphenamt, 29 Apr. 1869.

⁶⁶ BHStA, GDVA 676, Königl. Filial Bank Bamberg to Telegraphenamt Bamberg, 21 Jul. 1869.

delayed until the next day. The office of Frankfurt experienced this when ‘during the whole night, Nuremberg wouldn’t listen [...] and it was impossible even for the offices of Bamberg and Munich to wake Nuremberg up’.⁶⁷ In Bremen an alarm was installed in the telegraphist’s bedroom, to ensure that he could receive news of ships or other telegrams arriving from Bremerhaven during the night.⁶⁸ Business hours had begun to defy diurnal cycles.

As networks across Europe were interdependent for long-distance transmissions, advance warning helped ensure temporal coordination. Thus, the director of the telegraph administration in Paris wrote to the director in Frankfurt specifying that the ‘*Congrès international de bienfaisance*’ taking place in London was ‘holding this evening a long session at 8.30 and will require distant telegraphic communication. Please do whatever is necessary to ensure the transmissions which will be requested’.⁶⁹

On a more regular basis, the coordination of services depended upon office opening hours. The treaty establishing the *DÖTV* had initially stipulated that offices in the member states should be open from 7am to 9pm between April and September, and from 8am to 9pm during the remaining autumn and winter months.⁷⁰ By 1858, however, three categories of service had been established, roughly similar in all German states. The older, now standard opening hours were termed ‘full daytime service’ (*voller Tagesdienst*). The two new categories included offices with a ‘limited daytime service’ (*beschränkter Tagesdienst*) of 9am to 12pm and 2pm to 7pm during weekdays, and

⁶⁷ BHStA, GDVA 674, TelegraphenStation Frankfurt am Main to Telegraphenamt, 7 Nov. 1861.

⁶⁸ StAB, 2-R.15.b.1, Commission des Senats für die Häfen to Telegraphenamt Bremerhaven, 30 Nov. 1859.

⁶⁹ BHStA, GDVA 674, Telegram from Frankfurt to Munich, 12 Jun. 1862.

⁷⁰ *Zeitschrift des Deutsch-Österreichischen Telegraphen-Vereins*, 1 (1854), p. 4.

those able to send and receive telegrams on a 24-hour basis.⁷¹ The distinction between larger arteries and small ‘blood vessels’ of the network was thereby matched in temporal terms.

As a result, however, the original hierarchy based upon the exclusion and inclusion of localities from the network was supplemented by the position they were then afforded ‘ahead’ of or ‘behind’ others within the network itself. Now that all were theoretically included and operated according to a common framework, temporal hierarchies emerged between its principal users. As the *Handelskammer* for Mittelfranken explained in 1866, some places needed constant access to the telegraph, others needed it only ‘at particular times’ – if they were trading frequently during the autumn harvest, for instance.⁷² Other towns, such as Kissingen, initially only had an office during the summer ‘*Badesaison*’, later obtaining a limited service during the rest of the year.⁷³

Once again, these temporal hierarchies affected existing relations between localities. During the 1850s, for instance, the ‘*Erster Bürgermeister*’ of Nuremberg had noticed that the office in Ansbach, where the seat of local government was situated, closed around 6pm every day, rather limiting the possibility of communicating in case of an emergency. It was not until 1863, however, that, the office opening hours were extended to 11pm, so as to enable the *Regierungspräsident* to communicate with Munich, Nuremberg and the Ministry of the Interior.⁷⁴

⁷¹ *Dienstanweisung für die telegraphische Correspondenz auf den Linien des Deutsch-Österreichischen Telegraphen-Vereins* (1858), pp. 2-3.

⁷² StAN, Rep. D4, 67, ‘Antrag Hr Fröttek, Mitglied der Gewerbe und Handelskammer von Mittelfranken, die Erweiterung der Telegraphen-Netzes betr.’ 13 Feb. 1866.

⁷³ BHStA, GDVA 444, Telegraphenamt to Telegraphen-Ingenieur Seifert, 23 Jan. 1865.

⁷⁴ StAN, Rep. 270/IV, Nr. 4, ‘Bericht des ersten Bürgermeisters Nürnberg’, 29 May 1854; StAN, Rep. 270/IV, Nr. 4, ‘Freiherr von Brück to Oberamt Nürnberg’, 19 Dec. 1863.

Priorities now shifted as the utility of the telegraph was confirmed, particularly as it became engrained in business practices. The offices established across Germany in the 1850s, in Straubing and Barmen, for instance, had all provided a ‘limited daytime service’. In these towns, of 12,000 and 50,000 inhabitants respectively, it seemed at the time that ‘a limited service was accepted as sufficient’.⁷⁵ Barely a decade later, however, expectations had evolved.

‘As useful as the telegraph is to the public’, a petition from Straubing stated in 1860, ‘it is only such insofar as it is continuously [in large towns, both day and night] at the disposal of the public’. It was particularly disappointing, the letter continued, when one found limited opening hours in a town ‘from which it might be expected that a telegraph office exists with full daytime service’. The example was given of a visitor arriving by train at 12 pm, who was unable to execute his personal or commercial transactions until the office opened at 2 pm, by which time his family matters and business had passed. ‘This is the situation facing an outsider travelling through, but is a daily occurrence for the inhabitant of Straubing’.⁷⁶

Straubing, situated in the agricultural heartland of Lower Bavaria, was dependent upon its trade in cereals, and according to the *Handelsrat*, it could be assumed, by now, that merchants in grain and other produce were the most frequent users of the telegraph. As things stood, whilst the town’s weekly market opened on Saturdays at 8am, the first telegrams came in no earlier than 9.30, and sometimes later. By that time, produce had been bought, as it was well known that the main transactions were conducted within the first one or two hours of the market. If one then wished to telegraph the results of the

⁷⁵ BHStA, GDVA 440, Handelsrat Straubing to Telegraphenamt, 25 Nov. 1860; Stadtarchiv Wuppertal, Q II 15, ‘Von Eynern to Bürgermeister Bredt’, 28 Mar. 1856.

⁷⁶ BHStA, GDVA 440, ‘Gesuch um Einrichtung des vollen Tagdienstes bei der Station Straubing’, 23 Nov. 1860. On 13 December, full daytime service was granted by the Telegraphenamt: BHStA GDVA 440, Brück to Telegraphenamt, 13 Dec. 1860.

trade to Munich or Lindau, this could not be done until the office was free around 11.30, by which time those places had no interest in the matter. If one then sought to sell on some of the purchased products, a suitable offer might be received by 7pm, but by this stage it could not be received, as the office was shut until 2pm the next day (a Sunday).⁷⁷

The petition in itself is significant, as it demonstrates the extent to which the telegraph could help or hinder the integration of local trade in agricultural produce into state-wide exchanges. Not only merchants, but also agriculturalists became dependent upon prices which reflected the state of supply and demand on increasingly distant markets. In the case of Straubing, decisions were being made based upon demand over 300 kilometres away in Lindau, on the Bodensee. Changes in these conditions, moreover, and the price fluctuations they caused, could take place in ever shorter time-frames. The petition in Straubing was signed by five men, who also insisted that the *Handelsrat* and *Magistrat* could confirm that this was not merely ‘the interest of an individual, but of the whole town’. The town’s principal commercial activity was no longer part of a local economic equilibrium, but dependent upon a wider network.⁷⁸

Bremen, meanwhile, with 60,000 inhabitants and a thriving trade-based economy, certainly belonged to those larger towns evoked by the petitioners Straubing. Its expectations were set higher, therefore, and in 1865, the *Handelskammer* complained that the Hanoverian telegraph office in Bremen was open only from 7 or 8 am, depending upon the season, to 9pm. However, ‘night-time service exists for the offices of Hamburg and Hanover, as well as Emden,’ it explained. ‘Given the mercantile significance of Bremen’, it continued, and given that it was the second most important

⁷⁷ BHStA, GDVA 440, ‘Gesuch um Einrichtung des vollen Tagdienstes bei der Station Straubing’, 23 Nov. 1860.

⁷⁸ *ibid.*

source of telegraphic traffic for Hanover, it too should obtain such a service. Failing that, an extension of opening hours to 10pm, at the very least.⁷⁹

As in Straubing, the request put forward by the *Handelskammer* in Bremen hinted at changes in the German economic landscape. Its insistence on the significance of its relations with Hanover reflected the growing importance of a new production sector which had begun to pull the focus of the *Hansestadt*'s economy away from its overseas trade and towards the German market.⁸⁰

For similar reasons, a night-time service was introduced in Bremen's 'Prussian' telegraph office in 1867. When the Prussian government threatened to remove the service on the basis that 300 users had agreed that they could do without such extended opening hours, the *Handelskammer* protested that it remained essential as it enabled telegraphists to work around the clock and prevented the accumulation of telegrams which otherwise occupied the staff during the early hours of the day.⁸¹ Asserting the city-state's position within the telegraphic body involved ensuring that it was provided with access to an unrestricted flow of information – in effect, to be connected to one of the network's arteries.

The promise of a ubiquitous telegraph network had thus in practice necessitated the coordination of the service in both spatial and temporal terms. Conceptualising the network as an organism through which information was distributed not in regular nervous impulses, but in fluctuating flows enabled the administration to provide a common framework for the individuals communicating across telegraphic space. In doing so, it permitted the organic growth of different localities and regions which was

⁷⁹ StAB, 2-R.15.b.3, S.L. Riechter, Namens der HK an den Senat, 21 Mar. 1865.

⁸⁰ L. Maischak, *German Merchants in the Nineteenth-Century Atlantic* (Cambridge, 2013), pp. 197-220.

⁸¹ StAB, 2-R.15.b.3, Handelskammer to Senat, 23 Mar. 1867.

transforming the German economic landscape. On the other hand, it also created hierarchies within the network, raising expectations and realising fears that certain localities would push ahead or fall behind others. Eventually, these hierarchies would reveal the tensions between the different economic sectors which were developing simultaneously.

Local Orientations

Locally, telegraph offices constituted the final stage in the digital transmission of a message. There, it was converted, once again, into a handwritten (later printed) and material reality, to be collected, or delivered by hand to its addressees. Despite the technical limitations which emerged, time was theoretically homogenous across the wires of the network – the instantaneity of transmissions created one space of interaction. At the end of each line, however, the human link in the chain of communication, from the telegraphist to the messenger, re-introduced unpredictability in the attempt to provide a regular, uninterrupted service. Just as the growing number of towns and regions connected to the network had begun to reveal the different economic sectors dependent upon it, so the positioning of telegraph offices accentuated the socio-economic partition of local space.

The contracts and service regulations governing the running of the network had themselves upheld the notion that the telegraph should provide a continuous, uninterrupted, and rapid service at a local level. The regulations of 1858 for the *DÖTV* specified that, upon its arrival and registration, '[t]he messenger must carry the telegram along with the proof of receipt, directly (*ohne Aufenthalt*) to the home, place of business

of the addressee, or to the post'.⁸² The regulations emphasised that the receipt, registration and delivery of telegrams was to take place 'immediately'. This stipulation could only be ignored, if 'the recipient has produced a written declaration, stating they will only receive telegrams at a specific time'.⁸³

The administration's ability to serve a community according to these regulations, however, was determined by the distance between telegraph offices and the customers who deposited their telegrams, and which messengers would have to travel to deliver those received. As the director of the telegraph administration had explained in 1849, telegraph offices might be established in the railway stations of those towns possessing one, or else in the centre, near government buildings. He was personally in favour of establishing the office in the railway station, as the telegraph might then also be used in emergencies by railway personnel. Moreover, he believed, 'its use by governments and private individuals should not be particularly hindered by the distance of the railway stations from the towns'.⁸⁴

The perception of such distances among different sections of local communities, however, would prove a crucial point of contention. As the *Regierungspräsident* in Augsburg stated: '[T]he more distances of hundreds of miles disappear, the more thoughts and events are carried with the speed of lightning from one end of Europe to another, the more disturbing and sensitive the smaller distances in between will be which must be covered in order to reach the winged means of communication'.⁸⁵

The speed of the network's development and the initial uncertainty as to its utility had in fact resulted in a rather haphazard allocation of telegraph offices in different

⁸² *Dienstanweisung für die telegraphische Correspondenz auf den Linien des Deutsch-Österreichischen Telegraphen-Vereins* (1858), p. 32.

⁸³ BHStA, GDVA 674, Telegraphenamt to all Stations, 10 Dec. 1862.

⁸⁴ BHStA, MH 16882, Dyck to HM, 15 Dec. 1849.

⁸⁵ BHStA, MH 16882, Präsident der Regierung Schwaben und Neuburg to HM, 4 Feb. 1850.

towns. Even in Munich, no dedicated space was provided for the telegraph administration and the town's office until 1851. Initially situated in one of the rooms of the *Akademie der Wissenschaften*, where Carl Steinheil had worked, plans were drawn up in 1850 to adapt rooms in the *Handelsministerium* for the purpose.⁸⁶ In Bremen, the first telegraph office was established not in an official building, but in the *Museum*, home of the scientific association of the town, which was centrally located on the *Domshof*, near both the *Senat* and the *Handelskammer*.⁸⁷

By the 1860s, however, the location of each office had become a matter of importance to the network's primary users. In Augsburg, the telegraph office had initially been established in the centre of town, in the *Markgrafenthurm*, but in 1859 it had been moved to the railway station, outside the city walls, approximately one kilometre to the west of its previous location.⁸⁸ It was not long before the *Allgemeine Zeitung* publicly criticised the change and began reporting on individual delays in the delivery of their telegrams which it had caused.⁸⁹

Their outrage was supported by *Regierungspräsident* Ernst Freiherr von Lerchenfeld, who explained that, as the office possessed only two messengers covering day and night shifts, it took them an average of 45 minutes to go from the railway station into town and back. Indeed, as described at the beginning of this chapter, he had (almost!) suffered personally from this delay when he was asked to meet the king at the railway station. It took three or four times as long, he asserted, for a telegram to travel between the office in the station and its addressee as between Petersburg and

⁸⁶ BHStA, GDVA 372, Dyck, 'Bericht des Telegraphenamts', 7 Feb. 1850.

⁸⁷ StAB, 2-R.15.b.3, Extract aus dem Senatsprotocolle, 27 Dec. 1850.

⁸⁸ BHStA, GDVA 193, Ministerial Entschliessung, 23 Feb. 1850; BHStA, GDVA 193, Dyck to Präsidium Regierung Schwaben und Neuburg, 30 Apr. 1859.

⁸⁹ BHStA, MH 16882, Bericht, Präsident Regierung Schwaben und Neuburg to MInn, 14 Sep. 1859.

Augsburg.⁹⁰ Even the minister of the interior supported Lerchenfeld's complaint, emphasising that Augsburg was the third biggest town in Bavaria, and that removing the office from the centre of town was particularly painful for the 'high circles of society'.⁹¹

The *Gremium des Handelsstandes* wrote to the minister of trade for redress. Not only did addressees often have to wait for hours after the arrival of their telegrams to receive them, but sending such messages had become equally burdensome. Senders now had to waste time covering great distances to reach the office. If the weather was bad, they might even have to rent a hackney carriage to take them to the railway station (if one could even be found!), thereby significantly increasing the overall cost of the service.⁹²

Once again, however, *General-Direktor* Heinrich Gumbart highlighted the fact that only around eight private telegrams were handed in at the office every day, and state telegrams were sent only every six days, on average.⁹³ Whilst the office in the railway station was of great utility for other purposes, the income generated by local usage of the telegraph was too small to justify either the maintenance of a second office in the centre of town or the employment of extra messengers, as the complaints had requested.⁹⁴ Moreover, Gumbart believed that the existing arrangements were sufficient. The regulations for the use of the telegraph stipulated that 'the furthest boundary for the delivery of a telegram is that it should reach the hands of the addressee earlier than if it

⁹⁰ BHStA, MH 16882, Bericht, Präsident Regierung Schwaben und Neuburg to Minn, 14 Sep. 1859.

⁹¹ BHStA, MH 16882, Minn to HM, 16 Sep. 1859.

⁹² BHStA, MH 16882, 'Vorstellung und Bitte des Gremiums des Augsburger Handelsstandes', 5 Nov. 1859.

⁹³ BHStA, MH 16882, GDVA to HM, 21 May 1859.

⁹⁴ BHStA, GDVA 674, Dyck to Redaktion der *Allgemeine Zeitung*, 23 Jan. 1860.

had been sent by post'. As this was currently the case, he explained, the complaints put forward were exaggerated.⁹⁵

Whilst statistics provided the basis for the government's assessments, however, they did not take into account the relative value of each message for its recipients. As the *Handelskammer* for Schwaben and Neuburg emphasised 'the national-economic value of facilitating use of the telegraph institute in Augsburg [should] be assessed in relation to what is often, for many large circles, its significant content, rather than simply by the number of incoming and outgoing telegrams'.⁹⁶

The issue was compounded by the spatial distribution of these privileged users of the telegraph, however. As the *Gremium des Handelsstandes* pointed out, in keeping with service regulations, messengers were required to deliver telegrams following the order in which they had been received at the office. Pragmatically speaking, however, the practice was nonsensical, as it prevented a messenger from adapting his trajectory through the city to take the shortest possible route. When one considered that most manufactures were relatively far away from the city centre, where most trading establishments were based, this could lead to absurd delays in the receipt of messages.⁹⁷ In seeking to preserve the seemingly neutral sequence in time by which telegrams were ordered, the administration had highlighted the importance of the distances between its users.

When the decision was made in 1862 to re-establish a central office in the centre of town, leaving a subsidiary branch at the railway station, patterns of telegraphic traffic across the urban environment began to emerge. In order to decide upon the best location

⁹⁵ BHStA, MH 16882, GDVA to HM, 30 Sep. 1859.

⁹⁶ BHStA, MH 16882, *Jahresbericht der Handelskammer für Schwaben und Neuburg* (1860), p. 9.

⁹⁷ BHStA, MH 16882, 'Vorstellung und Bitte des Gremiums des Augsburger Handelsstandes', 5 Nov. 1859.

for the new central office, an analysis was prepared of telegrams sent between 1 and 12 March 1864. During that period, 267 of the 501 telegrams sent were from local inhabitants or owners of nearby manufactures. 334, however, were from travellers, or people only temporarily residing in Augsburg.⁹⁸ To begin with, this statistic highlighted the importance of the technology not only for a town's inhabitants, but for people on the move, seeking to coordinate their departure and arrival times and to manage their journeys across Germany. As a result, the majority of traffic was indeed in the railway station itself.

A list was also drawn up of the twelve most frequent resident depositors of telegrams during this same period, which highlighted the growing diversity within the economic elite now making use of the technology. Six of these were bankers (including Paul von Stetten), two were 'agents', two owned manufactures (including Ludwig August Riedinger, director of Augsburg's large Mechanische Baumwoll-Spinnerei und -Weberei), one was Consul Obermaier, and finally, Duke Ludwig. This almost unique source regarding the individual users of the telegraph confirms the suggestion that whilst finance and trade remained the leading source of demand, the production sector had also been drawn into the network. Whilst these represented different economic sectors, however, it was as yet still unlikely that users further down the social ladder would make much use of the technology.

Situating the telegraph office in a suitable location, therefore, required balancing the interests of the city's *Wirtschaftsbürgertum* in particular. Doing so, however, highlighted the different sections of urban space with which they were associated. As *Telegraphen-Direktor* Dyck pointed out in frustration, 'in not a single one of the

⁹⁸ BHStA, MH 16882, Dyck, 'Erinnerung', 15 Mar. 1864.

different vaguely formulated petitions and requests is there any indication of where the central point of traffic in Augsburg might actually be'.⁹⁹ The average distance of customers depositing three or more telegrams per week from the railway station had been measured, and determined to be roughly one kilometre (3717 Bavarian feet). Projecting possible alternatives for the telegraph office, Dyck noted that these same customers were on average at a distance of: 765 metres from the former office; 630 metres from the post office; and roughly 500m from both the police station and the *Börse*.¹⁰⁰ The difference between these options in the centre of town and the existing location was negligible, he believed – the true centre of traffic remained the railway station.

'It would be with far more justification', Dyck added, 'for the factory owners by the Stephinger, Jakober, Schwibbogen and Rother Thor to request the establishment of a subsidiary branch in the Jacobervorstadt'.¹⁰¹ Indeed, it was between the city walls and the *Lech* river to the east that many of Augsburg's historic bleachworks and newer spinneries had been established, dependent as they were upon waterways.¹⁰² Already in 1850, the Mechanische Baumwoll-Spinnerei und –Weberei, built outside the Jakobertor, was employing around 1,500 workers.¹⁰³ As the railway station was to the west of the city walls, however, many of these factories found themselves at around 2km from the office, as the crow flies.

Use of the telegraph had thus become a source of tension within Augsburg's bourgeois elite. Bankers had long been at the heart of the city's economic, and indeed

⁹⁹ BHStA, MH 16882, Dyck, 'Erinnerung', 15 Mar. 1864.

¹⁰⁰ BHStA, MH 16882, Dyck, 'Erinnerung', 15 Mar. 1864.

¹⁰¹ BHStA, MH 16882, Dyck, 'Erinnerung', 15 Mar. 1864.

¹⁰² C. P. Clasen, 'Die Augsburger Bleichen im 18. Jahrhundert', C. Grimm (ed.), *Aufbruch ins Industriezeitalter* (3 vols., Munich, 1985), ii., 184-225.

¹⁰³ W. Wüst, 'Die Manufaktur- und Fabrikarbeiterschaft als neue Gesellschaftsschicht im frühindustrialisierten Augsburg', *ibid.*, pp. 402-11; S. Fees, 'Die frühen Spinnereien und Webereien in Augsburg: Architektur, Maschine, Arbeit', *ibid.*, pp. 261-9.

social, life, and had even provided a large proportion of the capital required to reinvigorate, mechanise and expand the local textile industry.¹⁰⁴ However, now that both they and the manufacturers, as well as the editors of the *Allgemeine Zeitung* and the leaders of local government had come to depend upon the same service, the community of interests had been disrupted. The expectations placed in the speed of telegraphic communication had accentuated the importance of local distance, and highlighted the transformation of urban space. Situating the telegraph office, meanwhile, had come to represent a symbolic re-orientation of the local community's socio-economic focal point. No conclusive decision was reached as to the most convenient location for the telegraph office as a result, but in a reflection of enduring local priorities, it was eventually established in the *Börsengebäude*.¹⁰⁵

The problem of situating offices within each locality and arranging for their delivery cropped up throughout Germany during the 1860s, particularly affecting the press. The *Würzburger Anzeiger*, for instance, reported that 'we see the [office messenger] especially around midday, doing the rounds, often with half a dozen telegrams, whereby hours often go by before his return'. Meanwhile, the telegrams which had since arrived at the office and were destined for publication in the newspaper's pages had 'accumulated in such a way that, in the best of cases, they become useless'.¹⁰⁶

The *Mannheimer Anzeiger* similarly complained that due to 'narrow-minded politics', telegrams which were 'addressed to Mannheim and paid for accordingly' were in fact sent to Ludwigshafen, across the Rhine. A single messenger then crossed back

¹⁰⁴ F. Möller, *Bürgerliche Herrschaft in Augsburg, 1790-1880* (Munich, 1998), pp. 147-50.

¹⁰⁵ BHStA, GDVA 193, Geschäftsnummer 341, 7 Dec. 1867.

¹⁰⁶ *Würzburger Anzeiger*, 8 Apr. 1864.

over the river to deliver the messages, with consequent delays.¹⁰⁷ Yet with only 20 telegrams arriving in Ludwigshafen every day, of which only 10 were addressed to Mannheim, it was unreasonable to consider employing a further assistant.¹⁰⁸

Across these towns, therefore, choosing the location of the telegraph office meant selecting the economic and social focal point of the community, placing some segments of the population ‘ahead’ of others. For the *Regierungspräsident* in Augsburg, it was also a matter of administrative authority. He pointed out that the offices in Munich, Ansbach and Würzburg were in the town centre, and those in Speyer and Regensburg were in the very building of the local *Regierung*.¹⁰⁹

In Bremen, the telegraph office for the two principle connections to Bremerhaven and Oldenbourg had been relocated in 1855, but maintained in the very heart of the city-state.¹¹⁰ When the Bremen-Hannover line was opened in 1854, however, its office was placed at the train station, on the outskirts of town. Already, in the mid-1850s, therefore, complaints began to emerge that this office was unsuitably located for its target audience.

The *Handelskammer* represented these interests, and argued that the office should be moved to the vicinity of the *Börse* and the *Museum*. As usual, the complaint was that messengers employed to carry telegrams to and from various offices and addresses, were too slow. The main disadvantage, it was explained, was felt in the communication with Hamburg, particularly during the opening hours of the stock

¹⁰⁷ BHStA, GDVA 675, *Mannheimer Anzeiger*, 28 May 1865.

¹⁰⁸ BHStA, GDVA 675, Telegraphen-Station Ludwigshafen to Telegraphenamt, 29 May 1865.

¹⁰⁹ BHStA, MH 16882, Präsident Regierung Schwaben und Neuburg to MInn, 6 Dec. 1859.

¹¹⁰ StAB, 2-R.15.b.4.a, Extract aus dem Senatsprotocolle, 26 Nov. 1855.

exchange there.¹¹¹ An enquiry was undertaken into the cost of constructing an underground wire from the railway station to the centre of town, though its outcome is unclear. Ten years later, however, as the new *Börse* was built next to Bremen's central market place, it once again became the centre for telegraphy, as well as for the local news agency, Bösmann's.¹¹²

Crucially, the language used in expressing dissatisfaction revealed that the public perception of the telegraph service was changing. The *Regierungspräsident* in Augsburg, for instance, insisted that the intended savings which were at the heart of the closure of the original office made an 'unpleasant impression' upon the public, as could be seen in the article of the *Allgemeine Zeitung*. Prioritising his own use of the telegraph, he added that 'the matter of cost in relation to means of communication should not be given such weighty consideration, that administrative considerations are set aside...'¹¹³ The *Gremium des Handelsstandes* considered that 'serving the public well [...] is after all the primary task of all such institutes'.¹¹⁴

Whatever their motivations, petitioners consistently put forward the argument that the service's utility and its contribution to the general interest were more important than its financial viability. The *Neues bayerisches Volksblatt* mentioned the complaints of 'the provincial representative, bankers, merchants and editors', at the fact that the telegraph office was now a full fifteen minutes away from town. 'It seems as though', it continued, 'the public is there for the benefit of the telegraph, and not the telegraph for

¹¹¹ StAB, 2-R.15.b.3, Hr Fischer, Namens der Handelskammer to Senat, 25 Feb 1856; StAB, 2-R.15.b.3, Commission des Senats für das Telegraphenwesen to K. Han. General-Direktion der Eisenbahnen und Telegraphen, 28 Feb. 1856.

¹¹² StAB, 2-R.15.b.4, Vorsitz der Börsencommission, to Senator Duckwitz, 6 Dec. 1864.

¹¹³ BHStA, MH 16882, Bericht, Präsident Regierung Schwaben und Neuburg to Minn, 14 Sep. 1859.

¹¹⁴ BHStA, MH 16882, 'Vorstellung und Bitte des Gremiums des Augsburger Handelsstandes', 5 Nov. 1859.

the public'.¹¹⁵ Whilst the state was now recognised as the provider of communications infrastructure, its service was now considered a duty to society.

Delivery charges, meanwhile, accentuated the hierarchy between the commercial and financial elite living in town centres and the manufacturers situated beyond communal borders. In 1862, the *Telegraphenamt* had suggested that a charge of up to 2fl. 54 kr be fixed for the delivery of messages, according to the distance from the telegraph office. It could thus end up costing just as much to have the telegram delivered as it did to transmit it over considerable distances.¹¹⁶ Despite later reductions in fees, by the late 1860s numerous complaints were filed, from the owner of a mill in the Giesing suburb of Munich, for instance, or of the Krauss locomotive manufacture in Munich, who preferred 'written correspondence' as a result.¹¹⁷ In 1868, *General-Direktor* Gumbart even wrote to all telegraph offices stating that they were generally charging too much for the messenger service.¹¹⁸

When threatened with new delivery fees, Christian Ammon, a manufacturer of compressed yeast who lived at the very limits of the Fürth municipality, engaged legal proceedings against the *Telegraphenamt*. Ammon occasionally made intense use of the telegraph, 'particularly during significant stock market fluctuations', but as his lawyer explained, he simply did not have 'the luck to live in that part of this town in which the railway and the telegraph office were set up'. He did, however, live within the town limits, and there was therefore 'no visible reason, for which Ammon should be treated worse with regard to wired correspondence, than any other of his fellow citizens (*Mitbürger*), that is than the rest of the inhabitants of Fürth'. 'Within one and the same

¹¹⁵ BHStA, GDVA 675, *Neues Bayerisches Volksblatt*, 23 Jan. 1863.

¹¹⁶ BHStA, GDVA 674, *Telegraphen Amt* to Oberpost- und Bahnamt, 20 Nov. 1862.

¹¹⁷ BHStA, GDVA 676, Locomotivfabrik Krauss & Compagnie, to Telegraphendirection, 28 Apr. 1870; BHStA, GDVA 676, Karl Kraemer to Telegraphenamt, 7 Jun. 1868.

¹¹⁸ BHStA, GDVA 676, Gumbart, circular to all telegraph offices, 16 May 1868.

Gemeindebezirk’, his lawyer continued, ‘a distinction cannot be made, and is not made anywhere; it certainly would not comply with the fundamental basis of equality’.¹¹⁹ Use of the telegraph office had thus become an issue around which the legal foundations of a local community could be discussed, even in the context of a new, expanding industrial town such as Fürth.¹²⁰

Ammon’s legal challenge underscored the issues facing the telegraph administration. Access to the network was now widely accepted as a universal right. Exclusions could no longer be made on the basis of an individual or a locality’s relative economic importance. In practice, however, the need to balance different habits and frequencies of communication created distinctions within the network itself. Depending upon a town or person’s geographical position, they were placed ahead or behind others in the service provided by the telegraph.

Despite the expectations placed in the telegraph’s ability to conquer both space and time, therefore, it had made users all the more conscious of distances and relative speeds. Within local communities, these spatial and temporal distinctions were intimately related to individuals’ socio-economic functions, and the position which they occupied in the urban landscape which was transformed by the process of industrialisation. The effect of these changes was not the dissolution of communities, however, but their re-orientation around new principles and priorities.

¹¹⁹ BHStA, GDVA 676, Telegraphenstation Fürth to GD der VA, 6 Sep. 1869; BHStA, GDVA 676, Vorstellung des k. Advokaten Gunzenhäuser’, 20 Oct. 1869.

¹²⁰ On the construction of local citizenship in a ‘new’ town, see Oliver Zimmer’s discussion of Ludwigshafen in O. Zimmer, *Remaking the Rhythms of Life: German Communities in the Age of the Nation-State* (Oxford, 2013). pp. 143-150.

Global Ambitions

As state telegraph networks penetrated ever deeper into the countryside during the 1860s, a combination of technical advances, geopolitical circumstances and consumer demand began to broaden the horizon of communication beyond Germany, and indeed Europe. From the mid-1860s, the age of truly global communication set in, particularly as submarine cables vastly increased the telegraph's reach. After the failed attempt to lay a trans-Atlantic cable in 1858, others were established between Sri Lanka and India, Toulon and Corsica, Suez and Karachi, to list only a few – and a durable connection between Europe and North America was finally achieved in 1866.¹²¹ In the process, Werner Siemens found himself caught in the necessary entanglement of technology, business and international relations which supported the diversifying needs of the network's users. His experience spotlighted the emergence of new, transnational corporate actors in the field of telegraphy, with whom states would have to reckon in the incipient age of globalisation.

In 1857, having laid the foundations of the networks in both Prussia and Russia, as well as fulfilling contracts with railway companies, Werner Siemens lamented that 'the telegraph business is now becoming very ordinary and unprofitable. We wouldn't be disinclined to drop the whole thing and to cultivate other branches. There is no recognition of true progress, nor profit to be made in it. The customers are, with the exception of England, all [state] administrations, and for them the matter itself is always a minor issue'.¹²²

¹²¹ K. Beauchamp, *A History of Telegraphy* (London, 2001), pp. 144-5.

¹²² Werner to Carl, 22 May 1857, Werner in C. Matschoß (ed.), *Werner Siemens. Ein kurzgefaßtes Lebensbild nebst einer Auswahl seiner Briefe* (2 vols., Berlin, 1916), i., 122.

Certainly, Werner Siemens continued to manufacture apparatuses for railways, and reached agreements with the states building a pan-European network. The Crimean War had provided him with the opportunity to build the Russian network, for instance, and soon thereafter he watched intently as the possibility of hostilities in Persia appeared to offer new business prospects.¹²³ In the late 1850s, Austria had also seemed a likely source of interest as a country open to foreign talent, private investment and seeking to expand its network into Greece and Turkey.¹²⁴ But by 1861, he wrote that ‘the field of telegraphy is experiencing a tragic stagnation, which is leading to sterility’.¹²⁵

The problem was a lack of innovation in the field. ‘The current direction, only to make the cheapest, even slipshod product, and the simplest possible, such that any ass can use and understand, has brought progress to a standstill [...] this is currently a hindrance and takes away all desire to make improvements’.¹²⁶ The densification of state networks under way, indeed, required little new input, and relied upon the large-scale implementation of existing techniques. To Siemens, the building works ordered by governments such as that of Bavaria were simply more of the same. As Jürgen Kocka identified in his study of the company, the years 1847-66 saw little evolution in the structure, business and management of the firm.¹²⁷

The technical field as a whole did continue to produce ideas and innovations. The Prussian *Repertorium der technischen Literatur* listed 190 articles on telegraphy published between 1823 and 1853, but between 1854 and 1868 the figure rose to 923.

¹²³ Werner to Carl, 27 Dec. 1856, in Matschoß, *Werner Siemens*, i. 121.

¹²⁴ Werner to Wilhelm, 19 Jan. 1858, *ibid.*, i., 127.

¹²⁵ Werner to Wilhelm, 30 Dec. 1861, *ibid.*, i., 187-8.

¹²⁶ *ibid.*

¹²⁷ J. Kocka, *Unternehmensverwaltung und Angestelltenschaft am Beispiel Siemens 1847-1914: zum Verhältnis von Kapitalismus und Bürokratie in der deutschen Industrialisierung* (Stuttgart, 1969), pp. 58-62.

German-language contributions now held their own against the rest of Europe, with 185 of those listings drawn from the *ZDÖTV* alone, compared with 158 from the French *Annales télégraphiques*.¹²⁸ But the torch of innovation had been passed to an increasingly professionalised class of engineers, as the polytechnical journal *Dinglers* published ever fewer articles on the topic, leaving them to the more specialist publications. A report on the Paris Industrial Exhibition of 1867 went so far as to state that ‘the most extremely rapid development which electrical telegraphy demonstrated between 1837 and the beginning of the present decade allows us to recognise that the actual progress in this field in most recent times relates only to improvements and fulfilments of the known systems and the organs which belong to them’.¹²⁹

As Werner recognised, the basic principles underlying terrestrial telegraphy were now well understood, such that ‘every mechanic without capital and intelligence can present strong competition. The internal market has therefore been lost to us’.¹³⁰ Innovation was the key to business, as Werner Siemens knew: ‘To stand still is to move backwards for us, and one must always avoid making the first step backwards!’.¹³¹

In the late 1850s, therefore, Werner Siemens had already turned his attention to new developments in the field of submarine telegraphy. This was the area in which innovation was generating the most interest. In the technical literature, for instance, the novelty of submarine cables continued to stimulate articles in *Dinglers*. In particular, the run-up to the successful laying of the transatlantic cable in 1866 witnessed a sudden surge in articles on telegraphy, submarine telegraphy and the Atlantic project itself,

¹²⁸ B. Kerl (ed.), *Repertorium der technischen Literatur, die Jahre 1854 bis einschliesslich 1868 umfassend* (2 vols., Leipzig, 1873), ii., 452-77.

¹²⁹ ‘Die elektrische Telegraphie auf der allgemeinen Industrie-Ausstellung zu Paris’, *DPJ*, 186 (1867), pp. 249-71.

¹³⁰ Werner to Wilhelm, 3 Jan. 1861, in Matschoß, *Werner Siemens*, i., 172.

¹³¹ Werner to Carl, 13 Jan. 1860, in Matschoß, *Werner Siemens*, i., 157.

from 5 in 1864, to 14 in 1865, 23 in 1866, and 17 in 1867, before receding to a mere two articles in 1870.¹³² The novelty and potential impact of submarine telegraphy had sparked renewed interest in the field.

As the first (unsuccessful) attempts were made to lay a transatlantic telegraph cable in 1858, therefore, Siemens collaborated with a British firm to begin laying cables across the Mediterranean – the first, from Sardinia to Bona in Algeria. Already, he believed ‘it is time also to think a little about the Atlantic’, because it would ‘awaken many ideas’.¹³³ In the early 1860s, however, the technology remained limited and so stagnation persisted: ‘things are not really moving forward with telegraphy. People in the countryside have become too clever, and submarine telegraphy seems to lack both a reliable construction and a sufficient development of traffic to ensure that a cable pays for itself after a short while [...]’¹³⁴

A number of Siemens’ efforts were aimed at tapping into and creating internal demand for new products, as the spread of telegraphy diversified its user-base. The success and durability of his inventions were, in his own words, ‘subject to fashion’.¹³⁵ In the early 1850s, for instance, he had already sought to convince the French authorities of the need for intra-city telegraphs, a service which was only to spread in the later 1860s and 1870s.¹³⁶ In 1865, the Prussian government finally ordered him to install the first pneumatic post line between the central station and – unsurprisingly – the stock exchange in Berlin: ‘Hopefully, this will be imitated and create work’.¹³⁷

¹³² Statistics established on the basis of the contents listings for *DPJ*, vols. 35-238 (1830-80).

¹³³ Werner to Wilhelm, 29th Sep. 1858, in Matschoß, *Werner Siemens*, i., 137; Werner to Wilhelm, 21 Sep. 1858, *ibid.*, i., 136-7.

¹³⁴ Werner to Wilhelm, 3rd Jan. 1861, *ibid.*, i., 172.

¹³⁵ Werner to Wilhelm, 29 Feb. 1864, *ibid.*, i., 223.

¹³⁶ Werner to Carl, 26 Dec. 1851, *ibid.*, i., 88.

¹³⁷ Werner to Carl, 20 Feb. 1865, *ibid.*, i., 240.

But it was a combination of technological innovation and external developments which set Siemens' business on a new course. Conflict was once again a significant contributing factor, as military applications of telegraphy had become more important since the late 1850s. When the director of the Prussian Telegraph Administration, Oberst Chauvin, had begun to demonstrate interest in developing a military telegraph, Werner held high hopes for the influence that this investment would have upon his business: 'if Prussia, which currently determines the fashion in military technology, adopts the matter, then it will be used a lot'.¹³⁸ By the time of the Austro-Prussian war in 1866, Siemens found his business thriving as he struggled to produce cables quickly enough to cover the rapid advance of Prussian troops.¹³⁹

On one hand, therefore, Siemens benefitted from the geopolitical reconfiguration taking place in Central Europe from the middle of the decade. At the same time, his attention was also swayed by the desire to take advantage of changing global relations. The London branch of Siemens & Halske which was headed by Werner's brother Wilhelm was re-structured under the new name of Siemens Brothers in 1865, enabling them to benefit from Britain's imperial connections, and the opportunities which it afforded entrepreneurs.¹⁴⁰ The process sparked the departure of Werner's long-serving partner, Johann Georg Halske, but he believed that his brother Wilhelm now had 'the world's traffic in his hands'.¹⁴¹

The stimulus provided by the global expansion of telegraphy was at the heart of the transformation of Siemens' business, which Kocka places between 1867 and

¹³⁸ Werner to Wilhelm, 9 Dec. 1864, in Matschoß, *Werner Siemens*, i., 233.

¹³⁹ Werner to Wilhelm, 2 Jul. 1866, *ibid.*, i., 255.

¹⁴⁰ W. Feldenkirchen, *Werner Siemens: Inventor and International Entrepreneur*, ed. K. A. Kerr and M. G. Blackford (Columbus, 1994), pp. 76-83.

¹⁴¹ Werner to Carl, 4 Nov. 1863, in Matschoß, *Werner Siemens*, i., 218.

1873.¹⁴² With the creation of Siemens Brothers, Werner had laid the foundation for his own involvement in the construction of supra-national enterprises. The Indo-European Telegraph Company, which the London and Berlin branches of the firm created in 1868, was to build a landline to compete with Britain's submarine connections to India.¹⁴³ In managing the operation, Siemens believed it best to give the line 'an international character, independent of local governments', and under a single, unified administration. It was equally important that the employees remain independent of governments, for the peace of mind of 'the capitalists'.¹⁴⁴

Siemens had thereby joined the ranks of the global capitalists who now began to shape the future of telecommunication. Even the structure of Werner's business was reconfigured to facilitate its participation in large-scale undertakings. Keen to maintain full control, Werner had initially hoped to reach an agreement with the Rothschilds in expanding his firm.¹⁴⁵ But the age of private bankers' involvement in such projects had passed, transformed in part by the global securities market which the telegraph itself had facilitated. Discussions with bankers, including the Rothschilds soon revealed that creating a public company might not be avoided.¹⁴⁶ Eventually, in July 1867, Werner reluctantly began to consider turning not only the Indo-European Telegraph Company, but the entire Siemens enterprise in to a public limited company – although the decision was not taken until 1890.¹⁴⁷

¹⁴² Kocka, *Unternehmensverwaltung*, pp. 117-20.

¹⁴³ Feldenkirchen, *Werner Siemens*, 93.

¹⁴⁴ Werner to Wilhelm, 9 Mar. 1867, in Matschoß, *Werner Siemens*, i., 265.

¹⁴⁵ Werner to Carl, 5 Apr. 1867, *ibid.*, i., 266.

¹⁴⁶ Werner to Carl, 5 Apr. 1867, *ibid.*, i., 266; Werner to Wilhelm, 12 May 1867, *ibid.*, i., 270.

¹⁴⁷ Werner to Carl, 16 Jul. 1867, *ibid.*, i., 273; Feldenkirchen, *Werner Siemens*, p. 154.

Conclusion

Werner Siemens' initial despondency and renewed enthusiasm were intimately connected to the course of the development of telegraphy during the 1860s. From a relatively geographically exclusive technology, under the guidance of a liberal economic doctrine the telegraph network had become, in theory, ubiquitous. It provided a structure upon which all sectors of the economy, from agriculture, to manufacturing, trade and finance, could now depend. Using the homogenous 'standard time-orientation' of the network to coordinate their activities, businessmen and producers of all types engaged with the forces of industrialisation and market capitalism.

The burden thereby placed upon the network, however, had obliged the government to adopt a policy of managing the network 'organically', assigning each region or locality a position within thicker or thinner channels of communication. Restricted by the times at which their telegraph offices opened, and the capacity of the telegraphic 'blood vessels' to which they were connected, localities found themselves ahead or behind others. Within communities themselves, moreover, growing demand for access to communal telegraph services from residents engaged in different sectors of the economy accentuated the changing configuration of local space which was underway. As entrepreneurs such as Siemens began to push the boundaries of the network worldwide, meanwhile, new actors, new possibilities, and new constraints began to influence the shape of telegraphic communication.

Chapter Six: Between Conflict and Collaboration

In 1876, Germany's new *Generalpostmeister*, Heinrich Stephan, stood before the Reichstag to defend the recent introduction of a new telegraph tariff. The *Worttarif* in question had established a flat rate for transmissions made within the Reich's telegraph network, but had met with opposition from the deputies. Facing calls to re-introduce the former distance-based pricing zones, Stephan asserted:

‘Gentlemen, the issue also has its idealistic side. We have received this wonderful force of nature as a gift from the Creator, which rushes through entire sections of the earth in a second, and is essentially an annihilator of distance, and you now want to constrain this force according to the measure of a clod and hoof (*der Scholle und der Hufe*)! The development of large international exchange, in which we have had no zones for years, has long moved beyond “clod-tariffs” (*Schollentarif*). The power of this development is so irresistible that your attempts to introduce a small zone appear to me as though you are trying to construct a weak barrage on the territory of telegraphy, against the tide of world correspondence’.¹

For the man behind the Universal Postal Union of 1874, the shrinking of space over long, international and increasingly global distances, was the defining quality of telegraphy. But to his grandiose vision the conservative deputy Theodor Günther juxtaposed a different reality:

‘The *Generalpostmeister* has reminded us that we mustn't lose sight of the big questions of international correspondence; that it is no longer time to cling on to the hoof and clod. Gentlemen, by far the greatest part of the German people lives from the hoof and clod, and I would like to express the most vivid wish, that the *Generalpostmeister* [...] not withhold his goodwill from the interests of the hoof and clod’.²

The dispute between Stephan and Günther hinged on their assessment of the continued expansion of telegraph networks during the 1870s. On one side lay the view

¹ VDR (1876), vol. 1, 8 Nov. 1876, pp. 88-9.

² *ibid.*, pp. 89-90.

that instantaneous international communication had flattened space, removing the obstacles to direct social interaction across long distances. On the other was a heightened awareness of the importance of place, of the local communities in which telegraph offices were situated throughout Germany and the short distances within which vast swaths of the population lived their daily lives. The changes wrought by telegraphy were at the root of the visions held by both camps, one process fuelling the other. Engaged in a dialogue of the deaf, however, neither party wished to hear that their views were interdependent, and that the object of their discussion was the connection between the two.

With the founding of the Kaiserreich in 1871, the new *Generaldirektion der Telegraphen* established within the *Reichskanzleramt* inherited a web of state networks which had been expanding inwards and outwards for two decades. During the 1860s, pursuing the liberal objective of creating a ubiquitous network sustaining all economic activity, individual German states had initiated programmes to introduce the technology to the countryside. In parallel, new global telegraph companies had laid the first successful trans-Atlantic cable in 1866, and begun the ‘wiring of the world’.³

When the new *Generaldirektion* set to work, therefore, it was confronted with the interests and practices of a host of actors already administering and using existing lines. In 1873, the first director of the imperial telegraph administration, Oberst Meydam – a military man, in keeping with Prussian tradition, – launched a three-year construction programme intended to harmonise and complete the patchwork of state networks in operation across Germany. Upon his death in 1875, post and telegraphy were brought together under the authority of the new, civilian *Generalpostmeister*,

³ S. M. Müller, *Wiring the World: The Social and Cultural Creation of Global Telegraph Networks* (New York, 2016).

Heinrich Stephan. In 1876, he too launched a structural overhaul of the Reich network, multiplying the number of offices, and replacing the main arteries of communication with new, more capacious underground cables.⁴

The dual process of modernisation and nationalisation, elegantly described by Eugen Weber in the context of the French Third Republic, appeared to have been set in motion.⁵ Yet as the responses to Weber's work have shown, the process of state integration was never smooth, and it faced particular challenges in the context of the Kaiserreich, where the government faced a strong federal heritage.⁶ As Siegfried Weichlein has shown, the management of imperial postal and railway systems during Bismarck's tenure as chancellor actually fuelled the dynamic interaction of 'unitarist' and 'federalist' forces, which remained unresolved.⁷ In a similar fashion, the imperial telegraph administration was forced to balance its aims with those of the diverse social and institutional actors involved in managing the network.

In addition, the telegraph network locked the Kaiserreich into a system of global interactions. 'If the formation of worldwide networks can be described as "globalization" [...]', writes Jürgen Osterhammel, 'then the period from roughly 1860 to 1914 witnessed a remarkable surge of globalization'.⁸ Already in the 1850s, the formation of European networks had necessitated inter-state cooperation, of the kind

⁴ J.-O. Hesse, *Im Netz der Kommunikation: Die Reichs-Post- und Telegraphenverwaltung, 1876-1914* (Munich, 2002), pp. 51-3.

⁵ E. Weber, *Peasants into Frenchmen: The Modernization of Rural France, 1870-1914* (Stanford, 1976).

⁶ M. Cabo and F. Molina, 'The Long and Winding Road of Nationalization: Eugen Weber's *Peasants into Frenchmen* in Modern European History, 1976-2006', *European History Quarterly*, 39, no. 2 (2009), pp. 264-86; Cf. C. Applegate, *A Nation of Provincials: The German Idea of Heimat* (Berkeley, 1990); A. Confino, *The Nation as a Local Metaphor: Württemberg, Imperial Germany, and National Memory, 1871-1918* (London, 1997); For an early summary of research which began to demonstrate the salience of regionalism as a characteristic of European nations, see C. Applegate, 'A Europe of Regions: Reflections on the Historiography of Sub-National Places in Modern Times', *American Historical Review*, vol. 104, no. 4 (1999), pp. 1157-82.

⁷ S. Weichlein, *Nation und Region: Integrationsprozesse im Bismarckreich* (Düsseldorf, 2004).

⁸ J. Osterhammel, *The Transformation of the World: A Global History of the Nineteenth Century* (Princeton, 2014), pp. 710-1.

characterised by the *Deutsch-Österreichischer Telegraphen-Verein*. By the 1870s, the submarine cables now tying together the world's continents also forced governments to sit at the negotiating table with the large corporations by which they were managed - the rising 'Euro-American' elite seeking to profit from global communication.⁹ Cooperating, sometimes collaborating, with both regional and transnational actors was necessary to carving out imperial jurisdiction over portions of a network built across fluctuating borders. Telegraphy thereby tied the Kaiserreich into the process of 'delimitation and fragmentation' which accompanied globalisation.¹⁰

At the same time, the expansion of the telegraph network served to connect ever greater numbers of users across this range of local, national and global contexts. As we have seen, the pool of regular customers had grown slowly, and it would only begin to reach a mass audience by the turn of the century at the very earliest, but it had diversified rapidly. Over the course of the 1850s and 1860s, the network had come to serve the interests of bankers, merchants, news agents, manufacturers and industrialists, serving to strengthen the bourgeoisie's 'networks of means'.¹¹ Although it served primarily economic functions, the telegraph network did not, in theory, discriminate between its service to the finance, trade or production sectors across Germany. In this respect, it formed a crucial support structure which accommodated the variety of forms in which industrial capitalism developed across Germany.¹²

From the 1870s, this chapter will argue, the potential user base broadened beyond this essentially middle-class core, through the application of telegraphy to a

⁹ Müller, *Wiring the World*, pp. 231-2.

¹⁰ S. Conrad, *Globalisation and the Nation in Imperial Germany*, transl. Sorchá O'Hagan (Cambridge, 2010), p. 4.

¹¹ J. Seigel, *Modernity and Bourgeois Life: Society, Politics and Culture in England, France, and Germany since 1750* (Cambridge, 2012), pp. 1-37.

¹² G. Herrigel, *Industrial Constructions: The Sources of German Industrial Power* (Cambridge, 1996), pp. 111-25.

greater variety of tasks. As will be illustrated, the pressure thereby placed upon the network to fulfil a widening range of functions at one and the same time began to spotlight the rifts between the sections of the population communicating for different purposes. Since the 1850s, the telegraph had become a driving force of industrialisation and market capitalism, but it now accentuated the social dimensions of these economic processes. Social, rather than geographical variegation became the primary characteristic of telegraphic communication.

The purported universality of telegraphic communication which was increasingly praised at this time, therefore, effectively underscored the diversity in the social values of space and time. Divisions emerged among users within and across states, as well as between and within urban and rural communities, based upon their different uses of the technology - whether for short- or long-distance interactions, for the purposes of agriculture, finance, industry or to manage personal affairs. These were debated in the Reichstag but also played out in villages, towns and cities across Germany, where the need to accommodate a variety of expectations from the population led to conflicts over local space. Statistics may hint at state or regional patterns of communication, but they obfuscate the tensions reigning within them.

In short, the imperial telegraph network served as much to divide as it did to unite. And necessarily so, as financial and technical constraints limited its accessibility, and more numerous connections between individuals entailed greater competition for the available 'bandwidth'. The telegraph network forged new connections but also sharpened social divisions and furrowed them into the underlying terrain, just as it advanced processes of industrialisation, market capitalism, and community formation at

numerous levels.¹³ In doing so, it fuelled the hopes and anxieties associated with those socio-economic transformations. By multiplying the connections between people and places, it accentuated the dual process of interaction and differentiation which characterised the early years of the Kaiserreich.

The Organisational Quagmire

Article 48 of the Reich constitution which came into force on 4th May 1871, stated that ‘postal and telegraph systems will be established and administered across the entire territory of the German Empire as unitary state communications institutes (*als einheitliche Staatsverkehrs-Anstalten*).¹⁴ Both services fell within the jurisdiction of the *Reichskanzleramt* until the creation of the *Reichspost- und Telegraphenverwaltung* headed by Heinrich Stephan in 1875. Stephan had been a rising star in the world of communication - an ally of Bismarck’s and founder of the Universal Postal Union, his status at home and abroad would continue to grow over the next twenty years. By 1880, his department had been elevated to the status of *Reichspostamt*, Stephan himself was *Staatssekretär*, and *The Times* commented that ‘nothing is impossible with the German Postmaster General’.¹⁵

Yet the impact of the *Reichsgründung* as a turning point in the development of coordinated communications networks is all too easily overstated. As Thomas Nipperdey emphasised: ‘The German Reich was, to begin with that which is least appreciated and eagerly side-lined by national-liberal and social-liberal critical

¹³ Rather than conflating the processes, Stein Rokkan highlighted the differentiation involved in simultaneously unfolding processes of modernisation, industrialisation and nation-state formation: ‘Dimensions of State Formation and Nation Building: a Possible Paradigm for Research Variation within Europe’, in C. Tilly (ed.) *The Formation of National States in Europe* (Princeton, 1975), pp. 562-600.

¹⁴ E. R. Huber, *Dokumente zur deutschen Verfassungsgeschichte* (3 vols., Stuttgart, 1961-6), ii., p. 298.

¹⁵ Quoted in Weichlein, *Nation und Region*, p. 107.

historians, a federal state'.¹⁶ The challenge of balancing centripetal and centrifugal forces in the management of the railways and the post was equally stark, if not more so, in the realm of telegraphy. To some extent, this resulted from what Jan-Otmar Hesse describes as the 'volatile legal framework' by which it was governed: 'In the domain of telegraphy, one can barely speak of an economic constitution of the German Kaiserreich'.¹⁷

In particular, the *Reservatrechte* which had been agreed with the governments of Bavaria and Württemberg granted these states a significant degree of autonomy in the running of postal, telegraphic – and in the case of Bavaria, railway – networks. Article 52 of the constitution, which defined these rights, affirmed the Reich's power of legislation in postal and telegraphic matters, as well as its authority to negotiate international agreements, and to determine the conditions of public access and any fee exemptions. The governments of Bavaria and Württemberg, however, maintained the right to determine their own tariffs and service regulations, and to reach agreements with their immediate neighbours. Their income from these institutions was also independent of the Reich's.¹⁸ As Siegfried Weichlein has demonstrated, the *Reservatrechte* reinforced tendencies towards regional differentiation and were not, as Nipperdey nonetheless claimed, 'without great importance [...] vis-à-vis the new Reich's power of integration'.¹⁹

In logistical terms, the administration was also dependent upon the patchwork of state-owned and private railways along whose tracks many telegraph lines had been built. In the early 1850s, governments had established a jurisdictional distinction

¹⁶ Thomas Nipperdey, *Deutsche Geschichte, 1866-1918*, 3rd edn. (2 vols., Munich, 1995), i., 85.

¹⁷ Hesse, *Im Netz der Kommunikation*, pp. 52-3.

¹⁸ Huber, *Dokumente zur Deutschen Verfassungsgeschichte*, ii., pp. 298-300.

¹⁹ Nipperdey, *Deutsche Geschichte*, pp. 78-9.

between ordinary correspondence telegraphs and those used by railways for signalling purposes. Barely a decade later, however, they had turned once again to the railway companies, asking that their installations be opened to the public in an effort to improve access to the telegraph throughout the interior of their territories. The situation varied across the country: in Württemberg, the network was almost entirely state-run by 1870, but in Bavaria the private Ostbahn-Gesellschaft and Pfälzische Eisenbahnen managed a number of the crucial lines connecting previously neglected parts of the territory. In Prussia, over half of all telegraph lines were run by private railway companies.²⁰

In this regard, the powers of both the Reich and its constituent states were considerably curtailed compared with their western counterparts. In France, the state's monopoly over communication had been enshrined in a law of 1837, and from 1846, all conventions established with railway companies had secured its right to build and control the lines erected alongside the tracks, granting companies use of the telegraph in exchange.²¹ The British Telegraph Acts of 1868/9, meanwhile, had enabled the government to buy out the private firms operating telegraph lines, allowing for special agreements with railway companies in particular.²²

In Germany, on the other hand, until the creation of the *Reichsbahn* in 1920, the myriad railway administrations were constitutionally bound only to collaborate 'like' (*wie*), rather than 'as' (*als*), a unitary network.²³ As Weichlein argues, the federal nature of Germany's railways won out over unitarism.²⁴ Any Reich legislation on telegraphy, therefore, would be limited in its impact upon those lines managed by the various railway administrations. In fact, aside from various clauses in the imperial

²⁰ Hesse, *Im Netz der Kommunikation*, p. 53.

²¹ C. Bertho, *Télégraphes et téléphones: De Valmy au microprocesseur* (Paris, 1981), pp. 92-3.

²² S. Fari, *Victorian Telegraphy before Nationalization* (Basingstoke, 2015), pp. 161-204.

²³ Huber, *Dokumente zur Deutschen Verfassungsgeschichte*, ii., 297.

²⁴ Weichlein, *Nation und Region*, p.100.

Strafgesetzbuch which defined damage to state telegraph lines as an offence, the question of the state's monopoly over telegraphy had not been settled, and the first '*Telegraphengesetz*' was only issued in 1892.²⁵

In addition, the efficiency of the network was subject to relations with neighbouring states and, increasingly, private cable companies. For instance, the Munich-Paris connection had been destroyed during the Franco-Prussian war of 1870 – a conflict arguably triggered by Bismarck's careful editing of the infamous 'Ems dispatch' – and was not re-established until 1876.²⁶ The French administration, Heinrich Stephan later explained to his counterpart in Württemberg, '[made] no bones about deliberately avoiding the route through Germany for its correspondence, even taking detours to that end'.²⁷ Yet international communication, and the use of 'transit' lines across a state's territory, were a major source of revenue. In this case, the Paris-Vienna connection running through Karlsruhe, Stuttgart and Munich was thereby deprived of income. Even international cooperation, enshrined in the *Union internationale des télécommunications* of 1865, gave regulatory powers to an external body, particularly with regards to tariffs, and restricted the imperial administration's sphere of action.

The multiplication of submarine cables across the world, meanwhile, had shifted Germany's position within a broader network of communication, with new, direct connections obviating the need to use telegraph lines running through Central Europe. Much as the Bavarian administration had feared exclusion from an emerging European network in the 1860s, the imperial network now risked being bypassed by intensifying continental and global exchanges.

²⁵ F. Kilger, *Die Entwicklung des Telegraphenrechts im 19. Jahrhundert, mit besonderer Berücksichtigung der technischen Entwicklung* (Frankfurt am Main, 1993), p. 53.

²⁶ J. Steinberg, *Bismarck: A Life* (Oxford, 2011), pp. 288-9.

²⁷ BHStA, GD 235, Stephan to General-Direktion Württemberg, 3 Feb. 1875.

The combined effect of these internal and external factors upon the imperial administration was a systemic deficit, and was brought to light in 1873 when Oberst Meydam prepared a memorandum concerning the ‘development and completion of the German imperial telegraph network’.²⁸ This first major construction project was to be undertaken over the course of three years, from 1874 to 1876. It was to make up for the works which had initially been planned in Prussia in 1865, and later the North German Confederation, but which had been halted by the ‘political events which followed’.²⁹

The *Reichsgründung*, Meydam explained, had in fact worsened an already difficult situation, as the territorial acquisitions involved – the telegraphs of Baden and Alsace-Lorraine in particular - had altered the network’s ‘necessary and desirable organic structure’. ‘The extensive reduction’ of tariffs imposed by the Paris treaty of 1865, meanwhile, had reduced income to a greater extent ‘than could be balanced by the [related] increase in cheaper correspondence’. The new submarine cables between England, Denmark, Norway and Russia had ‘deprived’ the administration of the ‘not insignificant’ income from communications between those countries, which had previously taken place using German telegraph lines. Finally, railway administrations were able to ‘receive the full fee’ for the telegrams they transmitted along their lines, such that the state telegraph administration ‘[came] away empty-handed’.³⁰

In light of these structural and financial deficiencies, Meydam proposed a 4.1m Taler (12.3m Mark) injection of funds in order to complete the network. All places of ‘some importance in terms of traffic’ and possessing over 2,000 inhabitants were to be connected to the network. Over one quarter of the projected amount would be dedicated

²⁸ Hesse, *Im Netz der Kommunikation*, pp. 56-7; ‘Denkschrift, betreffend die für die Jahre 1874 bis 1876 in Aussicht genommene Entwicklung und Vervollkommnung des deutschen Reichs-Telegraphennetzes’, *Haushalts-Etat des Deutschen Reichs für das Jahr 1874*, Anlage XI, pp. 21-44.

²⁹ ‘Denkschrift’, p. 21.

³⁰ *ibid.*, p. 21.

to building or extending internal lines, but Meydam also prioritised international connections because of Germany's 'geographic position' in Europe. Again, over a quarter of the 4.1m Taler was to be dedicated to links with Germany's immediate neighbours. A net profit, he asserted, could soon be expected from connections between large centres of trade and industry.³¹

Implementing Meydam's '*Organisationsplan*' then set in motion the interlocking cogs of the federal administrative machinery. By this stage, the Bavarian telegraph administration was coming to the end of its own project to complete the state telegraph network, initiated in 1868.³² In fact, a year earlier the Bavarian administration had itself exerted pressure on the governments of both the Kaiserreich and the Austro-Hungarian Empire to review their networks: the poor quality of their lines was causing trouble for users making inter-state transmissions, effectively nullifying the positive impact of their improvements.³³

Meydam's project was nonetheless a spur to further development on the Bavarian side. Failure to match these efforts, the head of the Bavarian *General-Direktion der Verkehrsanstalten* Heinrich Gumbart asserted, would 'hinder the imperial government's measures with regards to connections with the Bavarian state telegraph and, moreover, would provoke bitter and not unjustified criticism on the part of the public, and give renewed support to those efforts aimed at removing the independent telegraph administrations'.³⁴ In a socio-economic variant of Hans-Ulrich Wehler's 'defensive modernisation', a combination of public pressure, logistical necessity, and

³¹ 'Denkschrift', p. 21.

³² See Chapter Five, p. 229.

³³ BHStA, GDVA 450, GDVA to MA, 30 Sep. 1872.

³⁴ BHStA, GDVA 234, Gumbart to MA, 20 Mar. 1873.

political strategy fuelled regional development in order to mollify public opinion and stave off political threats.³⁵

In any case, despite efforts to overhaul the network, by 1872 the volume of traffic on Bavarian lines had become untenable. Since 1868, the number of paid telegrams handled annually (*Staatsdepeschen* were free of charge) had increased from around 678,000 to over 1.5 million, thanks in part to a reduction in tariff introduced early in 1872.³⁶ As the director of the *General-Direktion* explained, where an average of 204 telegrams had been transmitted per kilometre of line in 1865/6, by 1872 the figure was 239.³⁷

A bill was then presented to the *Staatsrat* and the *Landtag* in 1873 by Bavarian Foreign Minister Adolph von Pfretzschner. He stated that efforts to reform the system earlier ‘without the collaboration of the imperial telegraph administration would have been [...] pointless’. Now that Meydam had presented his proposal to the Reichstag, it was ‘absolutely necessary’ for the Bavarian administration to complement these efforts on its own territory.³⁸ The Bavarian proposal explicitly followed the model put forward by the imperial administration, so that certain principles came to underpin both networks – in particular, that all towns of 2,000 inhabitants or more qualified for the establishment of a telegraph office. It also promised to take action to multiply its network’s ties to all towns bordering the German Empire.³⁹

Clearly, the Reich held greater sway than the individual states in certain areas of legislation and administration. Particularly after Meydam’s death in 1875, the re-

³⁵ H.-U. Wehler, *Deutsche Gesellschaftsgeschichte* (5 vols., Munich, 1987-2008), i., 343ff.

³⁶ BHStA, GDVA 234, Gumbart to MA, 20 Mar. 1873.

³⁷ BHStA, GDVA 234, Gumbart, ‘Voranschlag über die zur Erweiterung des bayerischen Telephennetzes herzustellenden Linien’, 25 Apr. 1873.

³⁸ BHStA, Staatsrat 7175, ‘Motive zum Gesetz-Entwurf’, 10 Nov. 1873; see discussions in VKA (1873/5), 19 Dec. 1873, pp. 114-9.

³⁹ *ibid.*

organisation of the united *Reichspost- und Telegraphenverwaltung*, launched by Heinrich Stephan and supported by Bismarck, gave a new impulse to the Reich's efforts to integrate transport and communications. The imperial administration was able to thwart Bavarian efforts to construct a telegraph line to the Pfalz, for instance, by claiming jurisdiction over the land which it would have to cross.⁴⁰ By 1880, the minister-president of Württemberg explicitly complained of 'Stephan's systematic efforts to demolish the respective *Reservatrechte*'.⁴¹

The point should not be over-emphasised, however, as relations between states and the imperial administration were marked by a strong degree of cooperation. To a certain extent, the Kaiserreich came to occupy the role previously fulfilled by the *Deutsch-Österreichischer Telegraphen-Verein* which it had dissolved in 1871. In Bremen, for instance, although the private *Telegraphen-Verein* was absorbed by the imperial telegraph administration, the latter relied heavily upon the advice and local authority of the city's *Senat* and *Handelskammer*.⁴² The archives of Bavaria's *General-Direktion der Verkerhsanstalten*, meanwhile reveal close interaction between Stephan and its director, Heinrich Gumbart, if only for logistical reasons.⁴³ Nor were influences uni-directional, and Stephan explicitly acknowledged that his efforts were aimed at bringing the imperial network to the same level of development as those in Bavaria and Württemberg.⁴⁴

⁴⁰ BHStA, GDVA 235, Heinrich Gumbart to Kais. General Telegraphen-Amt, 18 Apr. 1877.

⁴¹ BHStA, MA 109807, Bayerische Gesandtschaft to MA, 29 Oct. 1880.

⁴² See, for example, HKB, MA - P II 1, Bd. 2, 'Delbrück to Senat', 4 May 1868.

⁴³ See the agreements reached in the construction of lines, contained in: BHStA GDVA 234 and BHStA GDVA 235. For example, BHStA GDVA 235, Gumbart to Kais. Deutsche General-Direction der Telegraphen', 3 May 1875 requesting a bias-current connection between Ludwigshafen and Mannheim to support the completion of the Bavarian network in the Pfalz.

⁴⁴ H. A. Wessel, *Die Entwicklung des elektrischen Nachrichtenwesens in Deutschland* (Wiesbaden, 1983), p. 300.

The intricate system of interlocking parts involved in the management of the network defies simplistic assumptions as to the nature and role of the Bismarckian Reich. The developments evoked thus far took place within the context of growing tensions between government and the liberal majority in parliament, which culminated in a ‘conservative turn’ in 1878, when Bismarck turned away from the National Liberals and sought support from the Centre Party.⁴⁵ In economic terms, so the argument runs, this shift was encouraged by the depression which set in after the *Gründerkrach* of 1873, and was marked by a rejection of free trade in favour of protectionism. The era witnessed increasing state intervention, with policies aimed at regulating the economy, and eventually also the creation of a ‘*Sozialstaat*’, as welfare measures were introduced in the 1880s to pull the rug out from under the socialist movement.⁴⁶

Yet both government policy and parliamentary attitudes towards communications infrastructure present a far more complex picture. To be sure, Reichstag debates during the 1870s often reflected deputies’ frustrations at their lack of influence upon legislation in this, as in other crucial aspects of the economy. Complaints raised the fact that they were not given adequate statistical information upon which to assess government proposals, and tariff changes introduced in the middle of the decade led to accusations of administrative despotism. The Reichstag, it was argued, should be given more power to counter decisions by the *Telegraphenverwaltung* which might have a detrimental effect upon revenue and users.⁴⁷ But the administration of the telegraph network was connected to a raft of issues, attitudes to which cut across what are often identified as government or party lines.

⁴⁵ Wehler, *Gesellschaftsgeschichte*, iii., 866-73.

⁴⁶ *ibid.*, iii., 907-14.

⁴⁷ VDR (1873), 11 Jun. 1873, p. 1083; VDR (1876), 8 Nov. 1876, pp. 90-1; VDR (1877), 12 Apr. 1877, p. 394.

To begin with, there were certain issues upon which the government admitted its inability to effect change. The liberal Carl Schmidt, for instance, complained of the excessively high costs of communicating with England by telegraph, despite international agreements reached in 1875 which should have regulated the matter.⁴⁸ Admitting that he was powerless to force a reduction in fees, Stephan pointed to the lack of incentive among neighbouring states to clamp down on high costs. ‘As for the cable companies’, he added, ‘it is for their benefit that they are not pursuing a liberal tariff policy’.⁴⁹

The telegraph network’s dependence upon the railways, meanwhile, required deputies to re-consider their views on Bismarck’s 1876 *Reichseisenbahn* project, which would have entailed the state’s purchase of the private railway companies. Bismarck had couched his project in terms of serving the ‘public good’ (*öffentliches Wohl*) by removing the railways from the jurisdiction of companies purely driven by profit, thereby asserting the state’s capacity to better fulfil the economic objectives previously left to the market. The measure had therefore split the parliamentary majority, with National Liberals broadly accepting the unifying aims of a *Reichseisenbahn*, and Progressives allying with conservative particularists to oppose what was seen as unwarranted centralisation.⁵⁰

By 1878, true to this stance, the Progressive Eugen Richter similarly asserted that *Reichstelegraphen* were not needed everywhere. ‘[I]nstead of exciting the chancellor with complaints and reports about every collision which he has with the railways’, he insisted, the *Generalpostmeister* should take the time ‘to establish a friendly relationship with the railways’, and allow them to connect to state telegraph

⁴⁸ VDR (1877), 21 Apr. 1877, p. 803.

⁴⁹ *ibid.*, p. 806.

⁵⁰ Weichlein, *Nation und Region*, 60-7.

lines and improve the service to the public.⁵¹ This time, however, Richter had the support of the National Liberal Eduard Lasker, Centre Party leader Ludwig Windhorst, and the conservative Nordeck zur Rabenau. The priority, Lasker argued, was to provide those places deprived of telegraphic connections with an office, and only then to focus on state competition with the railways.⁵² Rallying around the defence of what they perceived to be the public interest, deputies had crossed party lines to oppose the government collectively.

The involvement of certain firms in the production of telegraph cables, meanwhile, also played into parliamentary attitudes towards industry. The Siemens firm, in particular, had benefitted from Heinrich Stephan's support. The new *Generalpostmeister's* appointment, indeed, had filled Werner Siemens with excitement: 'he is an energetic, enterprising man', he wrote, 'and we must now show him that he can achieve things with us!'⁵³ His hopes were vindicated when Stephan decided to support German business and, in an example of government-sponsored cartelisation, encouraged Siemens & Halske to compromise with their competitor Felten & Guilleaume, and collaborate in the laying of the network's underground cables.⁵⁴ When the issue was raised in the Reichstag, however, Eugen Richter asserted that although he was in favour of involving German industry in the production of the materials for the telegraph network, he believed that Stephan was showing undue preference for two large corporations.⁵⁵

⁵¹ VDR (1878), 28 Mar. 1878, p. 571.

⁵² *ibid.*

⁵³ Werner to Wilhelm, 10 Oct. 1876, in C. Matschoß (ed.), *Werner Siemens. Ein kurzgefaßtes Lebensbild nebst einer Auswahl seiner Briefe* (2 vols., Berlin, 1916). (2 vols., Berlin, 1916), ii., 503.

⁵⁴ Werner to Wilhelm, 10 Oct. 1876, in Matschoß, *Werner Siemens*, ii., 503; On the rise of cartel capitalism from the late 1870s as a means of defending against economic instability, see H.-U. Wehler, *The German Empire, 1871-1918*, transl. Kim Taynor (Leamington Spa, 1985), pp. 40-51.

⁵⁵ VDR (1879), 23 Mar. 1879, p. 579.

Whilst the state's management of the telegraph network was never seriously challenged, just as it was accepted in the field of postal communication, it was thus intrinsically connected to policies in other sectors of the economy, towards which attitudes were divided. Part of the problem, of course, was that in the wake of national unification, the liberal majority in parliament was deprived of the one clear policy which had united its members in the 1860s. As attention turned to economic issues, divisions emerged within its ranks, particularly as liberal theories of free trade were discredited following the *Gründerkrach*.⁵⁶ But the Reichstag debates also emphasise the importance of accounting for the multiple moving parts which together fuelled the telegraph's development. Business circles, for instance, often welcomed government intervention in the railway sector, whilst state policies towards the companies involved had themselves fluctuated over the course of the century, defying linear narratives of growing state intervention.⁵⁷ As will be explored below, government and parliamentary attitudes to the telegraph network were shaped by a broader discussion of the purposes of communication.

The Social Dimension of Telegraphic Communication

By the 1870s, the state's duty to provide the transport and communications infrastructure upon which the economy depended was widely accepted, if diffracted across the political spectrum. For the conservative Reichspartei deputy, Karl Gustav Ackermann, the state's monopoly was to be used to increase 'the capital of the nation'

⁵⁶ J. Sheehan, *German Liberalism in the Nineteenth Century* (London, 1982), pp. 123-80.

⁵⁷ As James Brophy has suggested, attitudes to state intervention within business circles were not always hostile, particularly in the wake of the 1873 *Gründerkrach* and ensuing depression which directly impacted the value of railway stocks: J. M. Brophy *Capitalism, Politics, and Railroads in Prussia, 1830-1870* (Columbus, 1998), pp. 168-72; cf. also, D. Ziegler, *Eisenbahnen und Staat im Zeitalter der Industrialisierung: die Eisenbahnpolitik der deutschen Staaten im Vergleich* (Stuttgart, 1996).

and its ‘entrepreneurial spirit’.⁵⁸ For Johannes Miquel, it was ‘not the task of telegraphy to bring revenue to the treasury, it is an economic institution, and serves economic purposes’.⁵⁹ Oberst Meydam himself had asserted that the extension of the network to smaller, unprofitable, localities was ‘justified by concerns for general utility and national assistance’ (*staatliche Fürsorge*). Telegraphy, he stated, was ‘an essential means of driving contemporary civilised life’.⁶⁰

Whilst the network was not primarily expected to contribute to state finances, however, the administration sought where possible to offset the costs which its development and maintenance incurred. As the principal source of revenue was the fees charged to the public for sending (and, in certain circumstances, receiving) telegrams, the size and composition of the network’s user base became the object of debate, particularly in the Reichstag, whose members placed pressure upon the administration to balance its accounts. The discussions which took place as result highlighted the different economic sectors which were now associated with the use of telegraphy, but also increasingly focused upon the social and demographic patterns of communication with which they were associated.

One means of improving the network’s viability was to encourage use of the telegraph among the largest portions of the population to which it was currently of little interest. Carl Schmidt explained that whereas each German received on average nineteen letters per year, they were expected to receive fewer than one telegram annually.⁶¹ ‘Telegraphic correspondence is still insignificant’, Schmidt declared, ‘and

⁵⁸ VDR (1871), 12 Nov. 1871, p. 269.

⁵⁹ VDR (1872), 24 May 1872, p. 491.

⁶⁰ ‘Denkschrift’, *Haushalts-Etat des Deutschen Reichs für das Jahr 1874*, Anlage XI, p. 21.

⁶¹ VDR (1872), 17 May 1872, p. 449.

statistics make it clear that *furor Teutonicus* has not yet been transformed into *furor telegraphicus*'.⁶²

In order to spread the practices of telegraphic communication, Schmidt believed, individuals should be inculcated with the right habits. 'We all know, gentlemen, that both the post and telegraph institutes stand in an intimate relationship with popular education. In those countries in which education is compulsory, the number of letters is greater than in those where it is not. Similarly, education also impacts the sending of telegrams'. One way of encouraging uptake of the service, in Schmidt's view, was therefore to familiarise people with it, perhaps by teaching children how to write 'laconically' in schools.⁶³

And yet, as the Bavarian administration had noted in earlier years, there appeared to be vigorous demand for the service across the country. For that reason, Meydam explained that the telegraph would only be viable if 'the desire for an extension of the telegraphic installations so often emphasised by so many parties is actualised by frequent use of it, as reflecting a widespread and general need'.⁶⁴ As Johannes Miquel understood, the problem was that 'the telegraph service is incessantly forced to construct unprofitable lines', particularly local connections, which were nonetheless 'economically necessary'.⁶⁵ Once again, then, the expansion of the network continued to serve a relatively small number of commercially active, and vocal individuals dispersed throughout the country.

The *Gründerkrach* of 1873 threw the spotlight on the stock exchanges in particular, and placed renewed pressure upon the administration to plug the systemic

⁶² VDR (1872), 17 May 1872, p. 449.

⁶³ VDR (1872), 24 May 1872, pp. 485-6.

⁶⁴ 'Denkschrift', *Haushalts-Etat des Deutschen Reichs für das Jahr 1874*, Anlage XI, p. 24.

⁶⁵ VDR (1872), 24 May 1872, p. 491.

deficit in the network. Telegraphic correspondence decreased by 1.7% after 1873, whilst postal exchanges remained unaffected, suggesting that finance was indeed at the heart of both the crisis and, consequentially, the technology's income.⁶⁶ The National Liberal August Grumbrecht went so far as to suggest that telegraphy had caused the crisis, by encouraging speculation among sections of the population who had no place or experience dealing in such financial matters.⁶⁷ Throughout the rest of the decade, indeed, discussions of the network's efficiency and financial viability were coloured by the perceived role of the stock exchanges in the depression, a consideration which drew deputies together across party lines.

Leopold Sonneman, a left-liberal and staunch opponent of the Bismarckian regime, regretted that most of the administration's spending went towards lines which benefitted 'merchants and such people who only occasionally send messages'. One way of increasing revenue, he believed, was to adopt the English practice of allowing the press to make use of telegraph lines during off-peak times, at a reduced cost. As for the *Börsen*, given their excessive occupation of the network's 'bandwidth', they should be taxed for the priority which their exchanges were effectively being given.⁶⁸ To Sonneman, mercantile interests as a whole were unduly privileged.

The administration's range of options was limited by external circumstances, however. As Carl Schmidt explained, the government was at the mercy of submarine cable companies which 'seek more to reap high dividend than to promote the interests of communication'.⁶⁹ The high tariffs they imposed upon transactions were inevitably reflected in the cost to German consumers. On the other hand, as the Progressive

⁶⁶ Hesse, *Im Netz der Kommunikation*, p. 57

⁶⁷ VDR (1875), 26 Nov. 1875, p. 328.

⁶⁸ VDR (1874), 7 Dec. 1874, p. 542.

⁶⁹ VDR (1875/6), 26 Nov. 1875, p. 320.

Leopold von Hoverbeck recognised, international treaties prevented the government from raising its own tariffs on foreign correspondence.⁷⁰ Besides determining the shape and extent of its network, the administration's options to increase revenue were effectively limited to the modification of internal tariffs.

It was just such a reform which the new *Generalpostmeister*, Heinrich Stephan, had in mind. Alongside his 34 million Mark project to replace the country's main telegraphic arteries with underground cables, and to build thousands of new state telegraph offices, Stephan introduced new tariff regulations. Following a conference in St Petersburg in 1875, he informed the Reichstag that the international community was moving in the direction of a *Worttarif*, or 'pay-per-word' system: 'In the last few days we have received the approval of France, England, Belgium and the Netherlands [...] and we have thereby made a good start. We will therefore, in normalising our new internal tariffs, provisionally go on the basis of the *Worttarif*'.⁷¹

This uniform tariff for the Reich telegraph network resembled the postal *Einheitsporto* which had recently been introduced.⁷² As things stood, telegrams were charged according to both a price category reflecting the total number of words they contained, and the distance over which they were being sent, for which a number of zones had been established. The *Worttarif*, by charging a flat rate of 5 Pfennig per word, and eliminating zones, effectively made the distance of individual communications irrelevant - a practice which had already been adopted in Bavaria and Württemberg, though at a slightly lower rate. To the homogeneity of time which the network promised to create, the *Worttarif* promised to add the uniformity of 'telegraphic space'.

⁷⁰ VDR (1874), 7 Dec. 1874, pp. 542-3.

⁷¹ VDR (1875/6), 26 Nov. 1875, pp. 329-330.

⁷² Weichlein, *Nation und Region*, pp. 118-20.

The policy provoked heated discussions in the *Reichstag*, however, and highlighted the fallacy that distance had been annihilated. Indeed, the flat rate introduced by Stephan was higher than that previously charged for telegrams sent within the first zone – that is to say, within the shortest radius. The conservative deputy and estate owner Theodor Günther therefore argued that the *Worttarif* would only be to the benefit of ‘*Großhandel*’ and ‘*Großindustrie*’. Unlike the post, he explained, only ‘particular classes are in the habit of sending telegrams over a long distance’.⁷³

Instead, Günther claimed to defend the rights of ‘agriculture in its entirety, the artisan class, the public, even the working classes’, who only sent telegrams over short distances – though he insisted that to do so was by no means to harbour any socialist inclinations. If the interests of these groups were instead supported, Günther believed that their ‘propensity to telegraph’ would increase, and thereby also the network’s revenue. What, Günther asked, did Stephan intend to do for the ‘vast majority’ of the population?⁷⁴ Long-distance communication, he made clear, was a habit of the elite members of the *Wirtschaftsbürgertum*.

Günther was supported by his colleague at the opposite end of the political spectrum, Leopold Sonnemann, who not only recommended giving ‘the public the opportunity to telegraph more’, but also revived the suggestion of imposing higher tariffs on stock exchange telegrams which required priority in transmission.⁷⁵ Lower fees, so the argument went, would encourage higher uptake of the service among the mass of the population, and thereby also income, whilst taxing trade and finance more heavily was justified by the extra burden which they placed upon the network.

⁷³ *VDR* (1875/6), 26 Nov. 1875, pp. 326-7.

⁷⁴ *ibid.*, p. 327.

⁷⁵ *ibid.*, pp. 327-8.

As the conservative and estate owner Nordeck zur Rabenau pointed out, however, this measure would effectively permit the members of the *Börsen* to buy the privilege of priority transmission.⁷⁶ Indeed, the technical constraints of the telegraph had a somewhat democratising effect on communication, insofar as messages could only be transmitted sequentially, one at a time. To allow traders on the stock exchange to pay for priority treatment would effectively privilege those classes involved in what to conservative minds was the rather questionable business of speculation.

In the end, Stephan took up some of the proposals, and announced that agreements had been reached with a number of newspapers to allow them use of the telegraph lines at off-peak times, at a reduced cost. Thanks to this agreement, Stephan stated, the *Kölnische Zeitung* printed extracts of the Reichstag proceedings in its daily paper. The Reich administration also introduced a tax on priority transmissions, setting the rate at three times the normal cost, a measure which was certain to hit the stock markets.⁷⁷

Resistance to the *Worttarif* continued into 1876, however, and increasingly revolved around the question of distance. Once the new policy was adopted in March, two deputies, the National Liberal Bernhard Schröder and the Progressive Wilhelm Spielberg, presented a request to the *Reichstag* asking that the first, most local zone, be re-introduced in parallel with the *Worttarif*. Keeping the cost of local correspondence low, Schröder emphasised, would favour exchanges from ‘locality to locality, small enterprise to small enterprise, as well as agriculture’.⁷⁸ To the needs and desires of finance, ‘*Großindustrie*’ and ‘*Großhandel*’ were thus being opposed those of a lower

⁷⁶ VDR (1875/6), 26 Nov. 1875, p. 328.

⁷⁷ *ibid.*, p. 330.

⁷⁸ VDR (1876), 8 Nov. 1876, p. 84.

stratum within the commercial and industrial bourgeoisie, whose interests were seen to align with those of rural producers.

The conservative Behr-Schmoldow displayed a characteristically conservative blend of hostility to both producers and consumers of an emerging global financial order. ‘Where did we get this disastrous *Worttarif* from?’, he asked. ‘I believe it comes from the transatlantic submarine cable companies’. These companies, he continued, charged per individual word in order to limit the length of telegrams transmitted and avoid overburdening their lines.⁷⁹

The companies he evoked were intimately connected with the agricultural crisis which had struck his class of Prussian estate owners, a consequence of cheap American and Russian grain flooding European markets. Their power, he implied, derived from a new reliance upon global communications: ‘ever since Europe is used to finding out about every tremor in the gold securities [market] in New York; ever since, as we recently discovered, the price of wheat in Chicago can suddenly rise when General Ignatieff has some boxes packed up’. Despite the fact that the greater part of all telegraphic traffic was local, he explained, the *Worttarif* had doubled the cost of telegraphing at a distance equivalent to the former first zone, but halved that for transmissions at a distance of three zones. In Bavaria and Württemberg, at least, the flat rate was much lower, at 3 Pfennig.⁸⁰

Heinrich Stephan admitted that the new tariff was in fact being adopted for the benefit of international correspondence, though he did not explicitly associate long-distance communication with a particular class.⁸¹ His resistance to the re-introduction of

⁷⁹ VDR (1876), 8 Nov. 1876, p. 85.

⁸⁰ *ibid.*, p. 85

⁸¹ VDR (1875/6), 26 Nov. 1876, p. 329.

zones led to the pronouncement quoted at the beginning of this chapter, and to Günther's response in defence of all Germans still living by the 'hoof and clod'. Once again, the conservative was joined in his opposition by Eugen Richter, who believed that the new tariff was 'an unfair increase in cost over short distances to the benefit of stock market exchanges'.⁸²

In more practical terms, Richter also questioned the very possibility of annihilating distance by means of reduced costs, as Heinrich Stephan proposed: 'The *Generalpostmeister* simply doesn't take distance into account; he says that space must be conquered, no attachment to the clods of earth. Gentlemen, yes, following this principle we would eventually come to the conclusion that we can telegraph to India or America for only 5 Pfennig, but you are well aware that this is impracticable'. Pointing out the technical limitations to providing cheap, long-distance correspondence, he added: 'this shows, however, that the principle should not be over exaggerated, that there is a limit at which [the *Generalpostmeister*'s argument] becomes wrong and counterfactual'.⁸³

Across the political spectrum, there was thus almost unanimous condemnation of, or at least frustration with the power of the new financial elite. Denouncing the privilege purportedly granted by the administration to stock exchange traders, and to a lesser extent large-scale merchants and industrialists, deputies upheld the right of the lower middle-classes, artisans and agriculturalists to affordable communication. The intimate connection between the *Gründerkrach* and the frenzy of investment facilitated by the new technology had led the *Reichstag* to spotlight the social, as well as economic dimension of telegraphic communication. When considering the purpose and structure

⁸² VDR (1875/6), 8 Nov. 1876, pp. 90-1.

⁸³ *ibid.*, p. 91.

of the network, it was not the particular activities pursued by the users which defined communities of interest, but rather their attitude to distance. Agricultural interests and artisans, but also small-scale enterprise, and to a lesser extent, workers, were allied insofar as they identified with practices of short-distance communication.

Indeed, despite the objections to the *Worttarif*, it established a rate of 1 Mark for an ordinary telegram of 20 words sent within Germany. In the mid-1870s, an independent craftsman in Münster could expect to earn up to 1,000 Marks in a year, and at around a third of his daily wage, the cost of telegraphing was perhaps exorbitant, but by no means prohibitive.⁸⁴ Communication across longer distances, however, and particularly using private submarine cables, remained well beyond the reach of ordinary Germans. Across the network, therefore, as new users poured in, social distinctions were being replicated, but they were being expressed in terms of distance, and the communicative horizons of the interested parties.

The *Worttarif* was eventually accepted, but the organisation of the telegraph network became intertwined with a further emerging social distinction. Whereas delivery fees had been universally abolished for postal services, the distribution of telegrams to individuals' homes was charged according to whether they fell within a particular range of a telegraph office. Those residing in a district without a telegraph office of its own (*Landbestellbezirk*) were required to cover the cost of delivering telegrams to their home. Yet it was generally in rural districts that such fees applied, effectively privileging urban residents who lived close enough to a telegraph office to receive their telegrams for free.

⁸⁴ K. H. Kaufhold, 'Grundzüge des handwerklichen Lebensstandards in Deutschland im 19. Jahrhundert', in W. Conze and U. Engelhardt (eds.), *Arbeiter im Industrialisierungsprozess: Herkunft, Lage und Verhalten* (Stuttgart, 1979), p. 153.

Graf Stolberg-Wernigerode, the conservative owner of a Pomeranian estate, complained of this inequality, arguing that if the delivery fees could not be abolished outright, all messenger services, regardless of their location, should be charged an equal amount – urban recipients of telegrams effectively subsidising the cost of reaching those living further away. This, Stolberg asserted, was the principle of ‘equalising justice (*ausgleichende Gerechtigkeit*)’.⁸⁵ He had the support of his fellow country estate owner, Behr-Schmoldow, who also complained of the disadvantage at which those living in rural areas were placed, and warned of a dispute ‘between town and countryside’. He too believed that all should pay for the delivery of messages, so as to spread the cost more evenly.⁸⁶

In this matter, the debate highlighted clearer social and party-political distinctions, as the conservative deputies representing rural interests opposed a policy which favoured urban dwellers. Opposing them, indeed, the Centre Party adherent Schorlemer-Alst turned their argument on its head. He too lived in the countryside, he explained, and similarly had ‘the luck, or bad luck, to receive telegrams often’. He lived 25 minutes by foot from the telegraph office and often paid up to 1 Mark to have his messages delivered. The fees were so high, he admitted, that he knew of craftsmen who had become messengers because of the generous wages involved. Whilst he therefore wished that these costs ultimately be reduced, he could not support the idea that to charge all users the same fee was to exact ‘equalising justice’, rather, it was to artificially overburden some to the benefit of others.⁸⁷

Eugen Richter also admitted to having suffered from this policy, during the few months in the summer when he lived in the countryside. He too agreed that delivery

⁸⁵ VDR (1877), 12 Apr. 1877, p. 407.

⁸⁶ *ibid.*, p. 398.

⁸⁷ *ibid.*, p. 407.

fees were set too high, but he blamed the fact that the political boundaries of rural communities were not drawn ‘rationally’, and did not therefore correspond to delivery zones. As for Graf Stolberg’s proposition to charge a flat rate to all users, however, which paid no regard to the cost of labour involved, he denounced it – to the amusement of the right-wing of the assembly - as a communist principle, far worse than social democracy.⁸⁸

In response to the discussion, Heinrich Stephan reminded the deputies that messenger fees could not be reduced at will. The administration, he claimed, was beholden to the individual messengers’ demands, as they were in a position to withdraw the service. For his part, he asserted that, by a logic of ‘*ausgleichende Gerechtigkeit*’, it would be more appropriate to favour the towns, whose business was currently compensating for the deficit created in the countryside. More stations were being built, he emphasised, to come closer to the people.⁸⁹

Basing their argument upon the principle of ‘equalising justice’, the conservative deputies had demonstrated the widespread acceptance of contemporary terms of debate. Their complaint revealed that access to the network was now considered a universal right, and that it was regularly used by members of a landowning, politically active class. In practice, however, the telegraph had also established distinctions between rural and urban localities, just as it had privileged certain sections of the *Wirtschaftsbürgertum* and excluded the artisans, workers and agricultural labourers whose plight was increasingly the source of political concern. The struggle of liberal politicians and the rising middle-class during the 1850s and 1860s to establish economic development as the primary objective of communication had largely been successful.

⁸⁸ VDR (1877), 12 Apr. 1877., p. 408-9.

⁸⁹ *ibid.*, p. 407.

But it had also drawn attention to the social divisions created by the forces of industrialisation and market capitalism which it supported. In this respect, the deputies themselves called for state intervention to balance the inequalities which were emerging.

The Promise of Universalism

It is within this context of broader concern for the ramifications of the economic transformations under way that Heinrich Stephan recast his vision for the future imperial network as a service which would transcend social and geographical divisions. By 1878, almost half of the 34 million Mark assigned to the project had been spent, the total number of publicly accessible telegraph offices within the imperial network had risen from 2,615 in 1871 to 6,842, and some deputies were calling for the tempo of construction to be moderated.⁹⁰ But Stephan believed that a further 850 stations should be built, and in an address to the Reichstag he waxed lyrical about the capacity for telegraphy to serve the needs and wishes of all Germans, urban and rural.⁹¹

‘think of the distilleries, brickworks, sugar plants, and then of the foundations of the wool industry, the breeding of sheep, the cattle trade, cereal trade, wood trade; all of this creates considerable long-distance exchange [...] And family interests too! How many families in the countryside have had to send their children to distant schools, *Gymnasien* and universities; their sons to the army, etc., and there can be instances in which it is a matter of dear interest, of peace of mind, of life and death, in which the most rapid transmission of news is of decisive importance [...] Think further, gentlemen, of instances where a doctor is called in all haste! [...] There are celebrations in the countryside; why should these be deprived of the comforts of the big cities?’⁹²

His concerns extended beyond the merely practical, moreover: ‘that which belongs to the beautification and the allure of life does not seem to me to be a matter of

⁹⁰ Wessel, *Entwicklung des Nachrichtenwesens*, p. 285. The figure includes railway telegraph offices, number increased from 1,485 in 1871 to 2,699 in 1878; VDR (1878), 28 Mar. 1878, pp. 565-6; By 1879, 18 Million Mark had been spent : VDR (1879), 24 Mar. 1879, p. 578.

⁹¹ VDR (1878), 28 Mar. 1878, p. 567.

⁹² VDR (1879), 28 Mar. 1878, p. 569.

indifference in ethical and cultural terms [...] the clergy in the countryside tend to telegraph quite a lot [...] there the telegraph sustains the currents of intelligence. With the telegraph, you give these places a tongue'.⁹³

Heinrich Stephan's triumphant tone re-affirmed his belief in the transformative power of telegraphy as a means of connecting all people and places. In providing this service equally to rich stock brokers and lowly peasants, the state was taking liberal principles one step further. *Verkehr* was recognised not only as intrinsic to economic activity, but as a social and cultural force. The telegraph, as Stephan imagined it, was now to bring progress and security to all Germans.

His profession of faith appeared to reflect transformations taking place throughout German cities, towns and villages, as the network's new, underground cables literally embedded the telegraph in the structures of everyday life. From a 'service' benefitting select groups in trade, finance, and administration, during the 1870s the technology became an infrastructure upon which a growing number of social interactions could rely. But now the pressure placed upon the network revealed social, as well as existing economic divisions between the interested parties.

In 1873, Oberst Meydam and Heinrich Gumbart, the director of the Bavarian *General-Direktion*, had set the minimum threshold for a municipality to obtain a telegraph office at 2,000 inhabitants, driving the technology further into the countryside.⁹⁴ In the Reich's telegraphic jurisdiction, the number of offices increased from 3,325 in 1873 to over 8,000 by 1880, reducing the number of inhabitants per office from over 24,000 to under 7,000.⁹⁵ In Bavaria the number of offices increased from 755

⁹³ VDR (1879), 28 Mar. 1878, p. 569.

⁹⁴ BHStA, GDVA 234, Gumbart to MA, 20 Mar. 1873.

⁹⁵ Wessel, *Entwicklung des Nachrichtenwesens*, pp. 293, 298.

to 1,112 in 1880.⁹⁶ In effect, moreover, among the new 115 offices planned in Bavaria, 38 were in locations with fewer than 1,000 inhabitants, including the village of Karpfham of only 197 souls.⁹⁷

In parallel, as the main channels of the Reich's network were buried into the ground, the country's telegraph offices were removed from their erstwhile, rented accommodation - often the result of expedient negotiations – and placed within new, dedicated buildings. The plan to design and build new *Telegraphenämter* across the country was initiated by Meydam, and vigorously pursued by Stephan.⁹⁸ The Munich telegraph office, previously situated in the central post office in the centre of town, was relocated to an independent building erected by the railway station in 1871, and in Berlin a new '*Kaiserliches Telegraphenamt*' was inaugurated in 1878.⁹⁹ Similar considerations led to the razing of a building at the heart of Nuremberg's market place, the *Tuchhaus*, and the construction of a new telegraph office in 1872. Bremen was granted a new *Post- und Telegraphenamt* in 1877.¹⁰⁰

The construction of central telegraph offices in larger towns spawned an array of subsidiary branches – '*Zweigstellen*' or '*Filialbüros*'. Just as the countryside was infiltrated by the network, so urban space was pervaded with access points which reflected the changing social composition of the telegraph's user-base. Munich's new central *Telegraphenstation* was connected to former offices in the *Hauptpostgebäude* and *Börsengebäude* which were now subordinated to it.¹⁰¹ In Bremen, new suburban

⁹⁶ *Rückblick auf das erste Jahrhundert der Kgl. Bay. Staatspost (1.3.1808 bis 31.12.1908)*, ed. Kgl. Bay. Staatsministerium für Verkehrsangelegenheiten (Munich, 1911), p. 253.

⁹⁷ BHStA, MA 109800, Gumbart to MA, 22 Apr. 1873.

⁹⁸ 'Denkschrift', *Haushalts-Etat des Deutschen Reichs für das Jahr 1874*, Anlage XI, pp. 23-4.

⁹⁹ *Rückblick*, pp. 163-4.

¹⁰⁰ StAN, D4 158, Stadt-Magistrat to Handelskammer, 17 Nov. 1869; Stadtarchiv Nürnberg, Stadtchronik, pp. 538, 746; HKBA, MA P II 1 Bd. 2, J. Albers, Namens der Handelskammer to Oberpost-Direktor, 27 Sep. 1877.

¹⁰¹ BHStA, MA 109800, GDVA to MA, 22 Apr. 1877.

branches reflected the growing importance of its manufacturing districts.¹⁰² In Elberfeld and Barmen, meanwhile, whose population was stretched out along a considerable portion of the Wupper river, small offices were set up through the valley at regular intervals.¹⁰³

Efforts were made to ensure the reliable and uninterrupted flow of information through urban and rural space. In Munich, a contract had been established with Zechmeister's Stadtomnibus-Institut, enabling messengers to use the omnibus service which was to 'traverse the entire city in every direction at intervals of 15 minutes'. Within the city limits, the institute was contractually obliged to deliver telegrams into the hands of the addressee within 30 minutes of the messenger's receipt of the message.¹⁰⁴ In large towns, the human element involved in the delivery of messages was bypassed as far as possible. From the 1860s, messengers were replaced with pneumatic telegraphs (*Rohrposten*), consisting of underground pipes through which small packages could be sent from one city office to another. These appeared in Berlin in 1865, in Vienna in 1875, and Munich in 1877.¹⁰⁵ In a similar vein, in 1879, the Bremen *Senat* granted the entrepreneur Carl Westenfeld a concession to establish a private urban telegraph network.¹⁰⁶

Permanent and uninterrupted telegraphic circuits came to underpin urban security as 'fire telegraphs' (*Feuertelegraphen*) were built throughout Germany. Siemens & Halske had introduced the concept in Berlin as early as 1851 but only later did the installation become widespread. In 1860, an urban signalling network was built

¹⁰² HKBA, MA P II 1, Bd. 3, 'Statistische Angaben über den telegraphischen Verkehr für das Jahr 1877'.

¹⁰³ Stadtarchiv Wuppertal, E V 22, Manuscript zum Verwaltungsbericht für das Jahr 1877.

¹⁰⁴ BHStA, GDVA 454, 'Uebereinkommen zwischen der Telegraphen-Central-Station München und dem Stadt-Omnibus-Institute', 11 Nov. 1871.

¹⁰⁵ Matschoß, *Werner Siemens*, pp. xliii-iv; 'Ueber pneumatische Anlagen zur Depeschenbeförderung', *DPJ*, 227 (1878), pp. 39-49; BHStA, MA 109800, Gumbart to MA, 27 Jul. 1877.

¹⁰⁶ StAB, 6,40-K.4.c., Mittheilung des Senats, 24 Jun. 1879.

in Stuttgart, with the municipal police department at its centre, to which were connected two of the city's church towers, the commander of the fire department, and a number of other strategically placed watch points.¹⁰⁷ This system facilitated the signalling of any outbreaks of fire and the coordination of responses to them. *Feuertelegraphen* were introduced in Breslau in 1865, Nuremberg in 1869, Augsburg and Aachen in 1871, Hamburg in 1872, Magdeburg in 1873, Elberfeld in 1874, Frankfurt am Main in 1875, Barmen in 1876, and the list goes on.¹⁰⁸

As an article in the *Deutsche Feuerwehr-Zeitung* explained, the security which these systems provided lay in the regular reports which could be circulated between a town's fire and policing agents. In Stuttgart, urban watchmen sent signals to the police station once every hour during the daytime, and every half an hour at night.¹⁰⁹ These urban safety networks could also be used for policing purposes, establishing a framework of information flow in and around towns and cities.

The vagaries of the weather were similarly subjected to the power of predictability which the telegraph promised. As early as 1850, the physicist Georg Ohm had suggested that the telegraph might be used to collect information on weather conditions, as well as other scientific observations.¹¹⁰ His call was initially heard by other scientists, but by the 1870s, August Zinn sought to convince the Reichstag of the importance of introducing a regular telegraphic meteorological reporting system. In particular, he pointed to neighbouring countries which had introduced such a system, and to 'the value, the national-economic value of reliable and prompt weather

¹⁰⁷ *Deutsche Feuerwehr-Zeitung*, 22 Mar. 1861.

¹⁰⁸ Stadtarchiv Wuppertal, G VIII 41, Brandrath Barmen: Bericht über die Anlage eines Feuer-Telegraphen, 26 Feb. 1878; 'Der Frankfurter Feuertelegraph', *Museums-Depesche: Informationsschrift des Feuerwehrgeschichts- und Museumsvereins Frankfurt am Main e.V.*, 20 (Dec. 2014), pp. 3-14.

¹⁰⁹ *Deutsche Feuerwehr-Zeitung*, 22 Mar. 1861.

¹¹⁰ BHStA, MH16802, Ohm 'Gutachten zum Bericht der Eisenbahnbau Commission', 21 Jun. 1850.

predictions' which enabled agriculturalists there to adapt to changing conditions as a result.¹¹¹ The regularity and reliability of information exchange which had primarily served business circles now extended to the countryside, and by 1881 services providing regular meteorological reports existed in both the Reich and Bavaria.¹¹²

When a new telegraph office was due to be built in Nuremberg, it came with the promise that both a 'meteorological station' and an electric clock would be installed in and on the building.¹¹³ The time coordination which had been crucial to telegraphic communication thereby spilled out beyond the confines of the telegraph office and into public spaces. As one report from the Vienna world exhibition in 1873 emphasised, '[i]t is now possible, with the help of electricity, to transfer the precision of a scientifically controlled astronomical pendulum clock to a whole system of clocks, not only in railways, post offices, stock exchanges, large administrative buildings, etc., but also in the streets and on the squares of large towns, and thereby to create a reliable and precise management of time for the complicated activities of large centres of population and administration'.¹¹⁴

What the telegraph could do for social life, moreover, it would also do for the state. In a characteristically conservative understanding of progress, the conservative deputy Bethusy-Huc asserted that the telegraph's 'principal value is not to be sought only its speed, rather especially also in the absolute security and reliability of its functions. If this is already the case for the ordinary business correspondence of the public, so it will be all the more applicable when considering the question of the Reich's diplomatic mission; to incidents [...] from which nobody can protect us with

¹¹¹ VDR (1879), 26 Mar. 1879, p. 619.

¹¹² Wessel, *Entwicklung des Nachrichtenwesens*, pp. 182, n. 206, 255.

¹¹³ StAN, D4 158, Magistrat to Handelsvortand, 12 Mar. 1869.

¹¹⁴ Anonymous, 'Die elektrischen Uhren auf der Wiener Weltausstellung', *DPJ*, 209 (1873), pp. 461-464.

certainty'.¹¹⁵ The telegraph was thus to structure both state and society. As one Reichstag deputy put it, the laying of underground cables projected by Heinrich Stephan was crucial in order that these 'nerves which traverse the Empire, these sensitive blood vessels, be protected from a chill'.¹¹⁶

The Reality of Differentiation

The many local, regional or global exchanges which could now take place throughout the telegraphic space of the network were anchored in the telegraph offices of Germany's many villages and towns. On one hand, therefore, the growing dependency upon the technology in day-to-day life placed it at the heart of the municipalities in which these offices were found. On the other hand, the many different directions in which the telegraph was pulled, whether to sustain familial interactions, commercial transactions, industrial relations, urban communication, or even the management of natural or man-made emergencies, threatened the relations between inhabitants of the same village or town.

As Oliver Zimmer has argued, however, the broader socio-economic and political transformations taking place in the second half of the nineteenth century did not cause the straightforward dissolution of local communities, but rather stimulated their re-configuration.¹¹⁷ The telegraph was one of the channels directly connecting not only urban, but also rural Germans to these transformations, and in doing so it did accentuate the underlying fragmentation of social relations at a local level. But it also provided a new structure using which to re-connect them.

¹¹⁵ VDR (1879), 24 Mar. 1879, p. 576.

¹¹⁶ *ibid.*, p. 579.

¹¹⁷ On 'placemaking' in German communities in the second half of the nineteenth century, see O. Zimmer, *Remaking the Rhythms of Life: German Communities in the Age of the Nation-State* (Cambridge, 2013), pp. 103-69.

By the 1870s, connections to the telegraph network were requested for any variety of reasons. In the village of Albersweiler in the Pfalz, for instance, such a request was made because its economic activities were now ‘directed more outwards than before, in brief the flourishing of industry is in step with trade’.¹¹⁸ But in Traunstein, towards the foothills of the Alps, much more localised concerns were at play. There, a doctor needed the technology in order better to implement measures when facing major medical epidemics - cholera, in particular. It was ‘essential, that the district doctor and the district police be in a position immediately to intervene personally, which can only happen if the announcements are made by telegraph [...] as in these instances, intervention, for example by examining the cause of death, ordering the burial, disinfection, etc. must happen in the first instance’.¹¹⁹

In the village of Unterrodach, in northern Bavaria, local concerns combined with broader commercial interests in one and the same place. In 1870, the local postal official had asserted that he would expect to handle 800-1,000 telegrams if a telegraph office were established there. At around three per day on average, this implied that only a small group of inhabitants would make use of the service. From the perspective of the local wood trade, however, this would be a crucial source of stability as it was experiencing the effect of market fluctuations: ‘the value of paper money often suddenly increases or falls as a result of apparently insignificant incidents, and the wood merchants can be very negatively affected if they have to wait until the news is brought by a post messenger or a newspaper’.¹²⁰ A few years later, the authorities called for a telegraph connection in the village to allay much more localised fears, namely the

¹¹⁸ BHStA, MH 16873, Gemeinderat Albersweiler to HM, 19 Apr. 1871.

¹¹⁹ BHStA GDVA 234, ‘Ausgenommen vom Protocoll, Dr Urban, K. Bezirksgerichtsarzt, Bezirksamt Traunstein’, 28 Aug. 1873.

¹²⁰ BHStA, MH 16873, Postexpeditor Unterrodach to HM, 24 Oct. 1870.

‘inestimable damage caused to the municipality in case of an outbreak of fire, or of illnesses for which rapid medical help from Kronach is immediately essential’.¹²¹

For Caspar Honegger, the Swiss founder of the large ‘Spinnerei, Weberei, Maschinenfabrik Kottern’, near Kempten, the telegraph promised to balance his participation in global economic transformations with the geographical constraints on his business. Hinting at the impact of cheap American cotton on the European markets, he evoked ‘the great competition, which is already developing in our branch of the cotton industry’. In order to survive in this context, Honegger’s establishment had to be ‘in the most direct connection with the consumers of the products as well as the deliverers of the raw material’. In England, where the tariffs on yarn had been considerably reduced, he pointed out, the industrialists possessed this advantage.¹²²

At the same time, Honegger had, of necessity, established his enterprise near a source of water, in order to power his machinery, and his manufacture found itself at too great a distance from the network as a result. It could take a few hours for the messages arriving at the office in Kempten to be delivered, and a further hour for the reply to be handed in, ‘and so half a day often goes lost, which given the very regular fluctuations in price which take place, can be disastrous and incur losses’.¹²³ The telegraph thus promised to cater to Honegger’s need both for relations with broader market structures, and for localised constraints on his production methods. It would thereby provide the infrastructure for the coordination of production and distribution.

Meanwhile, the network’s initial customers in the world of finance and trade remained in many ways its most demanding. In 1872, the *Handelskammer* of Schwaben

¹²¹ BHStA, GD der VA 234, Gemeindeverwaltung Unterrodach to General Direction, Telegraphen-Abteilung, 5 Oct. 1874.

¹²² BHStA, MH 16873, Caspar Honegger, Vorstand der Spinnerei, Weberei, Maschinenfabrik Kottern, to HM, 1 Mar. 1870.

¹²³ *ibid.*

and Neuburg expressed a now rather familiar complaint, claiming to speak for the *Börsenkommissariat* and businessmen across Bavaria: '[t]elegrams sent in the morning to Vienna and Berlin often receive a reply by night time or the next morning [...] and telegrams sent at the closing of the stock exchange in Frankfurt often do not arrive here on the same day'. The very 'existence and capacity of a second-rank exchange depends principally upon the fact that it is in continuous and the promptest contact with the price fluctuations of the leading trading emporia'.¹²⁴ Indeed, the pressure which the stock exchanges placed upon the network increasingly conflicted with the needs of its other users. As Heinrich Gumbart, explained of the situation in Augsburg, 'the *Börse* provides at most four percent of all correspondence, but requires a much speedier transmission of its telegrams than all other branches of communication, due to the task of completing its business during a trading day, or even to operate on two stock exchanges at the same time'.¹²⁵

As far as Gumbart was concerned, 'the telegraph administration should not be particularly inclined to expand its means - which suffice for commercial and family telegrams - to the benefit of the stock exchange which offers no equivalent in terms of mass usage outside the stock exchange's business hours'.¹²⁶ As the *Börsen* had adopted the telegraph en masse in its earliest stages, their numbers remained relatively constant, and as the pool of alternative users then expanded, the proportion of overall traffic which stock exchanges supplied was in decline. Commercial and industrial business, and gradually family correspondence, were all becoming similarly dependent upon its services.

¹²⁴ BHStA, GD der VA 450, 'Bericht der Handels- und Gewerbekammer von Schwaben und Neuburg', 5 Sep. 1872,.

¹²⁵ BHStA, MV I 2069, Gumbart to HM, 30 Sep. 1872.

¹²⁶ *ibid.*

Now, however, the Augsburg *Börse*, which was currently connected to Frankfurt by a telegraph line passing through Nuremberg, proposed that direct lines be established between Augsburg and Munich, Frankfurt, and Hof (towards Berlin). In other words, the proposed solution was that a network of direct inter-city connections be built which would speed up financial correspondence.¹²⁷ The *Börse*'s demands were no longer simply for preferential treatment within one and the same network, but for a more personalised, dedicated connection.

In fact, the request was part of a pan-European initiative to secure the channels of communication for financial transactions. Efforts had been made to reach an international agreement which might enable certain lines to be dedicated to the 'Börsenpublikum' during business hours, and at a higher tariff.¹²⁸ Similar requests to Augsburg's were being put forward by other towns, and the Dutch telegraph administration was seeking to build a direct line between Vienna and Amsterdam 'in the interest of the not insignificant stock exchange correspondence'.¹²⁹ The common dependence of all telegraph users upon one and the same network had thus led to requests for a differentiated service.

These emerging conflicts of interest between different ranges and practices of telegraphic communication began to affect the social configuration of the localities in which they converged. New telegraph offices built in important towns often displaced the service from the *Börse* in or near which they had originally been situated. In Bremen, the Reich administration's plan to move the office to the new *Oberpostdirectionsgebäude* provoked complaints on the part of the *Handelskammer*. 'The telegraph office was given its current place', it explained, 'on the one hand

¹²⁷ BHStA, GDVA 450, Bericht der TStation Augsburg Stadt to GDVA, 27 Sep. 1872.

¹²⁸ BHStA, MV I 2069, Gumbart to HM, 30 Sep. 1872.

¹²⁹ BHStA, GDVA 234, Hauptdirection der Niederländischen Staatstelegraphen to GDVA, 16th Jul. 1873.

because it is at the centre of the town, but also because all trade correspondence is undertaken at the *Börse*, in particular during trading hours, and it is of vital importance for this correspondence [...] that it be in a position to use the telegraph at all times without losing any time’.¹³⁰

Despite the *Handelskammer*’s complaints, the main telegraph office was indeed removed to the new post office building in 1878, but it was promised that a branch office would be established in the *Börse*. The administration insisted, however, that a space be provided for this branch office free of charge, ‘based on the understanding that the installation of this subsidiary is not necessitated by general correspondence [emphasis in the original], rather is solely a measure for the benefit of the stock exchange’s traffic’.¹³¹ Broader interests were now being more clearly distinguished from the needs of a financial and mercantile elite. The *Handelskammer* reluctantly accepted this compromise, insisting that urgent telegrams nonetheless always be forwarded to the new central office ‘immediately after being handed over, without waiting for other telegrams to be collected’.¹³²

The re-configuration of Bremen’s network, both through the displacement of the *Börse* from its centre and the opening of new branches in the city’s suburbs, was a direct challenge to its ‘hometown’ traditions, which had revolved around the merchant and shipping community.¹³³ In 1879, for instance, telegraphic traffic at the Bremen *Börse*, from which 19,500 telegrams had been sent, was considerably outpaced by that at the new central telegraph office, where the figure was 179,000. Moreover, telegrams

¹³⁰ HKBA, MA – P II 1, Bd.2, Handelskammer to Generalpostamt, 8 May 1875.

¹³¹ HKBA, MA – P II 1, Bd.2, Oberpostdirektor to Praeses der Handelskammer, 25 Aug. 1877.

¹³² HKBA, MA – P II 1, Bd.2, J. Albers, Namens der Handelskammer to Oberpostdirektor, 21 Sep. 1877.

¹³³ HKBA, MA – P II 1, Bd. 3, ‘Statistische Angabe für den Bezirk der HK für das Jahr 1877’; HKBA, MA – P II 1, Bd. 3, ‘Statistische Angabe für den Bezirk der HK für das Jahr 1879’.

were now being sent from the offices in the surrounding districts of Neustadt, Horn and Hastedt, although numbers there remained around or below 1,000.¹³⁴

The affront to Bremen's elite was reflected in its reluctance to adapt to new practices. Much to the administration's frustration, the *Börse* had refused to adopt the practice of using telegraph stamps, as was by then customary at larger stock exchanges.¹³⁵ It then refused to adopt the delivery procedure common at other, larger stock exchanges, where telegrams were handed over by messengers to the exchange's employees, who then sought out the addressee concerned. Instead, the *Handelskammer* insisted that, in this much smaller *Börse*, the telegrams still be handed over personally to each recipient.¹³⁶

The symbolic significance of the change was just as important as its practical consequences. A complaint was made in 1879, for instance, that only one member of staff had been present at the *Börse*'s new, subsidiary office on a given day. The counter clerk, it turns out, had been called in to help with an unusually high workload at the central station, and it was demonstrated statistically that the individual left in charge at the *Börse* branch had been quite capable of managing the twenty or so telegrams which were handed in during his colleague's absence.¹³⁷ The complaint clearly derived from the perceived rather than actual neglect of the *Börse*.

In Munich, meanwhile, Heinrich Gumbart recognised that the relocation of the *Telegraphenamt* to a building by the railway station 'brings with it inconveniences for previously privileged classes within the population'. He therefore considered proposals

¹³⁴ HKBA, MA – P II 1, Bd. 3, 'Statistische Angabe für den Bezirk der HK für das Jahr 1879'.

¹³⁵ HKBA, MA – P II 1, Bd.2, Oberpostdirektor to Praeses der HK, 29 Nov. 1876; HKBA, MA – P II 1, Bd. 2, Oberpostdirektor to Praeses der HK, 6 Jan. 1877.

¹³⁶ HKBA, MA – P II 1, Bd. 3, F. Reck, Handelskammer, to Oberpostdirektor, 30 Nov. 1878.

¹³⁷ HKBA, MA – P II 1, Bd.2, Kaiserliches Telegraphenamt to Präsident der Handelskammer, 10 Jun. 1879.

for the introduction of a pneumatic post to connect the city's various offices.¹³⁸ As work got under way in 1876, it was decided that the installation should be constructed so as 'later with the increase in Munich's population, to include the suburbs of Au, Haidhausen, Schwabing, and Sendling'.¹³⁹ When the installation was inaugurated a year later, it was announced that 'a transmitter and receiver has been established on a trial basis, upon the urgent wishes of the local *Handelssgremium* [...] in the building in which the *Börse* is located'.¹⁴⁰

As in Bremen, the symbolic displacement of a privileged social group within the network was just as important as its concrete implications. When the pneumatic post planned for Munich was first discussed in parliament in 1873, its utility was openly questioned. As the former minister of trade, Gustav von Schlör explained, however, 'there are now some things in the world which are desired by public opinion with such determination and emphasis, that one cannot successfully oppose them in the long term, and I include among them the installation of a pneumatic connection between the *Centralstation* and the *Localstation*. Even if you prove by a hair's breadth and with mathematical certainty that the telegrams would not lose a minute if they were handed over to an omnibus, a messenger or a horse-drawn carriage [...] not a single person will believe you, and if only for this reason, this installation is necessary'.¹⁴¹

Whereas the conflicts in Augsburg, Bremen, and to a lesser extent, Munich had focused upon the centre of trade and finance, in Nuremberg, it was a broader alliance of businessmen which felt most threatened by changes to local infrastructure. When the central market place had been designated as the site of a new telegraph office, the

¹³⁸ BHStA, GDVA 234, Gumbart, 'Voranschlag über die zur Erweiterung des bayerischen Telegraphennetzes herzustellenden Linien', 25 Apr. 1873.

¹³⁹ BHStA, MA 109800, Gumbart to MA, 6 Feb. 1876.

¹⁴⁰ BHStA, MA 109800, Gumbart to MA, 22. Apr. 1877.

¹⁴¹ VKA (1873/5), 19 Dec. 1873, p. 116.

administration had promised to maintain the existing, original office in the railway station as a subsidiary branch, operating along exactly the same lines as before. In August 1872, however, a petition from over 700 local businessmen (*Geschäftsleute*) was brought forward, supported by the *Handelskammer* and *Gemeinde der Bevollmächtigten*, pointing out that the now subordinate role of the office at the railway station was unacceptable.¹⁴²

Ignoring statistical evidence to the contrary, the businessmen and manufacturers petitioning the government asserted that the majority of correspondence emanated from the railway telegraph office – that is to say, outside the city walls, where most industrial activity had developed.¹⁴³ The administration's promises to preserve pre-existing arrangements, in their view, could only be fulfilled if a specifically *telegraphic* connection between the two offices was established. Despite the administration's explanations, the *Handelskammer* insisted that 'the carrying of telegrams to the main office by messengers, even if it takes place quickly and regularly, implies a loss of time relative to the previous transmission by telegraphic route, because as far as we understand, those telegrams transported by [...] messengers must be placed in a queue'.¹⁴⁴

Conflicts over local space had thus intensified since the 1860s, when it had first begun to emerge that different sections of the population within one and the same municipality sought access to the telegraph. Then, the debates had centred upon the positioning of a primary office which was to serve the needs of the community as a whole. As urban geography often reflected the socio-economic composition of a locality, the outcome effectively privileged one professional group. By the 1870s, the

¹⁴² Stadtarchiv Nürnberg, C11/I (KA 4), Nr. 389, Antrag der Kämmerei Commission, 10 Aug. 1872.

¹⁴³ *ibid.*

¹⁴⁴ StAN, D4 158, Handelskammer Nürnberg to Stadt-Magistrat, 7 Aug. 1872.

communal nature of the telegraph was itself increasingly put into question, as multiple offices were built to serve the various needs of the population dispersed across an expanding urban environment, and the rifts between social groups were accentuated. At the same time, however, the construction of telegraph offices came to reflect a restructuring of local communities around these urban networks, placing the former ‘telegraphic elite’ alongside new sections of the population, often outside the traditional town centres.

Individualisation

In 1874, an article in *Die Gartenlaube* encouraged its readers to show more precision when addressing their telegrams. ‘A telegram to “Herr Müller in Berlin” is naturally undeliverable from the outset’, it explained, ‘for which of the thousand Müllers is the right one? [...] A precise address also requires a precise description of the location, if there are a number which have the same name. A telegram to Strassburg, for instance, can be sent to Alsace but also to West Prussia’.¹⁴⁵ In itself, the publication of this article implied that such practices were not yet habitual or natural to many users. As Carl Schmidt had informed the Reichstag, unlike the traders on the stock exchange, most people were ‘not so well informed of the distances’ across which they communicated.¹⁴⁶ For many, telegraphing involved a re-orientation of oneself within a broader space of interaction.

Even within the localities served by the telegraph, the role of the individual was underscored. The *Feuertelegraphen* established in cities throughout the country, for example, served the safety of the urban community as a whole. The original systems put

¹⁴⁵ R. Billig, ‘Ein Plauderstündchen bei der Depeschen-Annahme’, *Die Gartenlaube*, 26 (1874), pp. 418-20.

¹⁴⁶ VDR (1872), 18 Jun. 1872, p. 1110.

in place during the 1860s functioned by connecting the town's designated watchtowers, ensuring continuous surveillance from above. By the mid-1870s, however, when the *Feuertelegraph* in Nuremberg was modernised, and a new system introduced in Barmen, the emphasis was placed on individual participation.¹⁴⁷ The *Brandmeister* of Frankfurt, called in to consult on Nuremberg's system, advised establishing a network of 9 principal stations, and at least 25 '*Feuermelder*' spread out throughout the town. These were effectively fire alarm triggers, which contacted the central authorities directly, and their number could and should be multiplied according to individuals' preparedness to have one affixed to their homes and businesses.¹⁴⁸

According to the Frankfurt *Brandmeister*, the participation of individuals was all the more necessary in smaller towns, as one could not rely on frequent passing traffic to notice a possible fire outbreak, as might be the case in a much larger city like Berlin.¹⁴⁹ In Nuremberg, after calls for participation were issued through local newspapers, 31 individuals agreed to the affixing of a publicly accessible *Feuermelder* on their buildings, and a further 16 requested that the switch be for their private use alone. Among the respondents were a number of master bakers, a lithographer and the owner of a brewery – those whose properties faced a greater risk.¹⁵⁰ In Barmen, similar calls for participation were sent directly to over 140 individuals and businesses, and even to eight local fire insurance companies which, it was felt, were directly affected by the

¹⁴⁷ Stadtarchiv Nürnberg, C 7/I, GR, Nr. 4383, 'Bericht des Brandmeisters Wolfermann', 29 Oct. 1877; Stadtarchiv Wuppertal, G VIII 41, 'Bekanntmachung', 9 May 1877.

¹⁴⁸ Stadtarchiv Nürnberg, C 7/I, GR, Nr. 4383, 'Bericht des Brandmeisters Wolfermann', 29 Oct. 1877.

¹⁴⁹ Stadtarchiv Nürnberg, C 7/I, GR, Nr. 4383, 'Bericht des Brandmeisters Wolfermann', 29 Oct. 1877.

¹⁵⁰ Stadtarchiv Nürnberg, C 7/I, GR, Nr. 4383, Beschuß des Verwaltungsrathes der Feuerwehren, 5 May 1878; Stadtarchiv Nürnberg, C 7/I, GR, Nr. 4383, Wolfermann to Magistrat, 3 Jul 1878.

installation.¹⁵¹ Communal security and solidarity increasingly depended upon the explicit participation of the individual.

In technical terms too, telegraph apparatuses were being designed with the general public in mind, rather than trained telegraphists. Siemens & Halske's *Feuersignalgeber*, was to offer 'the possibility of a rapid and reliably comprehensible signalling of a danger of fire by people who are unversed in telegraphy, as can be of great value in locations at risk, such as storage rooms, theatres, etc.'. ¹⁵² Other apparatuses, such as Keiser and Schmidt's '*Depeschentableau*', aimed to dissociate the practice of telegraphy from any prior knowledge or understanding of the technology, as a new concern for 'house telegraphy' emerged which would bring it into people's homes. ¹⁵³ It was during this decade, moreover, that the first apparatuses were developed which accurately reproduced an individual's handwriting. ¹⁵⁴ Although these did not find their way into ordinary people's homes, they illustrate a concern for the personalisation of telegraphic correspondence.

It was in manufacturing and trade that the greatest stimulus for the individualisation of telegraphy was first felt, however. Throughout Germany, regulations on the establishment of telegraph lines for private use remained unclear until the 1890s. Since the 1850s, however, the Bavarian government had been considering the matter, particularly with regard to railway companies, and by the 1860s, individuals had begun to come forward requesting permission to establish telegraph lines between different branches of their businesses. In 1863, for example, the ironmonger Kustermann in Munich had wished to connect his home to his depot. After negotiations

¹⁵¹ Stadtarchiv Wuppertal, G VIII 41, Oberbürgermeisteramt to Direction der Rheinischen Provinzial-Feuersocietät zu Düsseldorf, 3 June 1878.

¹⁵² Anonymus, 'Feuersignalgeber von Siemens und Halske in Berlin', *DPJ*, 209 (1873), pp. 395-6.

¹⁵³ Anonymus, 'Keiser und Schmidt's Depeschentableau', *DPJ*, 199 (1871), pp. 464-5.

¹⁵⁴ Du Moncel, 'Meyers autographischer telegraph', *DPJ*, 209 (1873), pp. 111-2.

involving his lawyer, Kustermann was granted permission, on the condition that the municipal government agree too, that the state be entitled to intervene at any time and to survey his correspondence, and until such time as official regulations were issued.¹⁵⁵

No official ruling was made in Bavaria, and for decades to follow, the only directive was that issued on 27 January 1863, that all requests for private telegraph installations be addressed to the Ministry of Trade, to be considered on a case by case basis.¹⁵⁶ This arrangement was thought sufficient to protect state interests ‘without unduly inhibiting the free movement of the individual in the realm of industry’.¹⁵⁷ The decision soon led to requests for individualised access to the state network itself.

In Bavaria, the first such successful request was put forward by a spinnery in Blaichach, in the Allgäu region in 1869. The manufacturer asked that the state provide a telegraph line between their establishment and the nearest telegraph office, a request which was approved on the condition that the spinnery pay interest of around ten percent of the installation costs. Around the same time, another spinnery in Senkelbach made a similar request, and a trend was thereby set.¹⁵⁸

As Heinrich Gumbart explained, the administration’s approval was based on practices which had developed in Switzerland to bring to isolated or disadvantaged locations and manufactures ‘a lively traffic’.¹⁵⁹ In those regions of decentralised production, the network had provided a crucial means of coordinating and integrating markets. The interest in this function in Bavaria was clear, and the potential pressure which would result for the administration was raised by the minister of trade: ‘if even a hundred private individuals make claims to the same preferential treatment as the

¹⁵⁵ BHStA, MH 16876, HM to Regierung von Oberbayern, KdI, 29 Apr. 1863.

¹⁵⁶ BHStA, MH 16876, Circular, HM to Kreisregierungen, 27 Jan. 1863.

¹⁵⁷ BHStA, MH 16876, Dyck to HM, 2 Apr. 1863.

¹⁵⁸ BHStA, MH 16873, Gumbart to HM, 19 Jan. 1869.

¹⁵⁹ *ibid.*

Spinnerei Blaichach, which is imaginable, even probable, then the cost [... would] significantly curtail the available means'.¹⁶⁰

Over time, an increasing number of private enterprises reached arrangements with the state and municipal governments in order to tailor the network to their needs. In 1870, the Swiss entrepreneur Caspar Honegger, evoked earlier, connected his isolated spinnery to the telegraph office in Kempten.¹⁶¹ In 1873, the founder of the renowned Badische Anilin- und Soda-Fabrik (BASF), August Clemm obtained a connection between his factory and the telegraph office in Ludwigshafen in order to avoid 'time-consuming messenger transport between both points'.¹⁶² Further agreements were reached with the Leineck spinnery and a manufacture near Bayreuth, an iron foundry near Eisenberg, and a manufacture of printers near Würzburg.¹⁶³

As demands for individual connections multiplied, the network was reconfigured. The München-Dachauer Aktien-Gesellschaft für Maschinenpapier Fabrikation asked for permission to connect two branches of its business, one in Dachau, the other in a Munich suburb, to ensure 'quicker, direct and uninterrupted exchange' between them. Concerned that this constituted a private network parallel to the state's, in 1873 Heinrich Gumbart suggested that the two branches be connected *via* the Munich central office, which would effectively serve as a switchboard.¹⁶⁴ With this compromise, the Bavarian administration had sketched out the blueprint for a new form of individualised communication. Driven by the needs of a manufacturing sector eager to establish very localised connections to a potentially global network upon which it

¹⁶⁰ BHStA, MH 16873, HM to GDVA, 23 Jan. 1869.

¹⁶¹ BHStA, MH 16873, Gumbart to HM, 5 Apr. 1870.

¹⁶² BHStA, MA 109807, August Clemm of BASF to MA, 19 May 1873.

¹⁶³ BHStA, MA 109807, Gumbart to MA, 26 Jun. 1873; BHStA MH 16873, Gumbart to HM, 23 May 1870; BHStA, MA 109807, Regierung Pfalz, Kammer des Innern, to MA, 18 Sep. 1878; BHStA, MA 109807, Gumbart to MA, 3 Apr. 1879.

¹⁶⁴ BHStA, MA 109807, Gumbart to MA, 20 Dec. 1873.

depended, it had developed the principle of the central switchboard through which eventually, in theory, any two individuals could be placed in contact.

Conclusion

During the 1870s, the expansion of the telegraph network had continued to enrol an ever growing number of actors, both metaphorically - in its construction, - and literally - in its consumption. As the network simultaneously penetrated deeper into the countryside and extended further across the globe, the stakes of cooperation between the administrators, legislators, technicians, businessmen, and even messengers who ensured its operation were raised. During the early years of the Kaiserreich, this chapter has argued, developing the technology had thereby heightened existing constitutional and administrative tensions between the states, and further highlighted their relationship to the private railway and submarine cable companies concerned. Oscillating between conflict and collaboration, however, the relations between these actors reflected their growing dependence upon one another in an era of complex infrastructural and economic development.

Intrinsic to the efficiency and financial viability of a communications network, meanwhile, was the demographic composition of its user base. The *Gründerkrach* of 1873, which had been intimately related to the stock market speculation facilitated by the telegraph, spotlighted the distinctions which had been emerging since the 1860s within the *Wirtschaftsbürgertum* making use of the technology, as well as the elite of the agricultural sector now tied into international markets.

Discussions in the Reichstag revealed that these distinctions had broader ramifications, however. They hinged on the social and economic value of distance, and

demonstrated that whilst the telegraph had opened up broad spaces of interaction for some, it had also accentuated the importance of place for others. Distance became a means of distinguishing between the telegraphic practices of different groups, and of establishing social, rather than merely economic alliances. When it came to transmission fees, agriculture, artisanal work and small-scale enterprise were brought together against finance on the basis of their narrow communicative horizon, rather than their economic interests. On the other hand, delivery fees placed town and country at odds with one another, precisely because of the relatively longer distances separating individuals in rural areas.

Within local communities, meanwhile, the multiplication of offices initiated to counteract the disadvantages created by distance became an opportunity for both social differentiation and re-configuration. The telegraph network had revealed rifts within expanding urban communities, but had provided them with a new means of restructuring local relations. By the end of the decade, technical innovations began to create opportunities for users to re-position themselves as individuals within a broader network. Telegraphic communication continued to evolve along the same trajectory, connecting and distinguishing ever greater numbers of people and places by enhancing the interdependence between them.

Conclusion

In 1878, Werner Siemens lectured to the *Akademie der Wissenschaften* in Berlin on the prospects for the latest technology of communication. ‘The impressive achievements of Bell and Edison’s electric telephone’, he stated, ‘are justifiably drawing a great deal of attention from scientists. The problem of transmitting sounds and speech to distant places, which it resolves, promises to give humanity a new means of communication and civilisation which will significantly influence its social relations, and will also perform significant services to science!’¹

Three years later, the engineer and now Prussian *Regierungsrat* Max Maria von Weber shared his observations from a recent visit to the United States with the *Handelskammer* of Frankfurt am Main. He described ‘the enormous development of personal communication, still barely imagined in Europe, most prominently by means of the telephone, as a central element in the strength of economic life and endeavours in the states of the Union’. There, Weber believed, ‘one has understood that economies in time and, equally significantly, labour, grow in a geometric relationship to the number of individuals who are able to engage in free, direct oral communication’. The achievements of the telephone in the realm of public administration were also extraordinary. A high-level official had told him that ‘we barely care for the local proximity of our institutions and administrations any more, for even if they are distributed across the entire city, we speak from one room to the next as though we were standing side by side’.²

¹ W. von Siemens, ‘Ueber Telephonie’, in *Gesammelte Abhandlungen und Vorträge* (Berlin, 1881), p. 425.

² BHStA, MA 109807, ‘Mittheilungen der HK zu Frankfurt a.M.’, 1 Jan. 1881.

Within a decade of the founding of the German Kaiserreich, a new object had thus caught the attention of the scientific, engineering and business community. Like telegraphy almost half a century earlier, the idea of telephony raised broad expectations in the potential transformation of communication, enrolling a wide array of developers and users, but its precise qualities and applications were yet to be determined. Notwithstanding its apparent novelty, the terms in which this object was understood once again drew upon the heritage of a discourse on communication which stretched back beyond the early nineteenth century, and in which telegraphy had now come to occupy a particular space.

Indeed, as we have seen, the transmission of speech had been at the heart of Karl Steinheil's vision for the telegraph during the 1830s, and articles published in *Dinglers* had included a number of proposals for means of attaining that objective. Over the years, some of the ideas being circulated in the emerging field of telegraphy were reconfigured to address the question of reproducing the human voice, as was the case with Philipp Reis' 'improved telephone' in 1863.³ The innovations which were to make the names of Alexander Graham Bell and Thomas Edison did not therefore emerge in a vacuum, and their reputation as inventors was itself a product of contemporary debates, legal proceedings and subsequent historical narratives.⁴

From its initial implementation, moreover, the telephone drew upon communicative practices which had formed around the telegraph. The peculiar initial organisation of the telephone as a primarily urban network, connecting businesses and individuals over short distances, derived from the arrangements made in the 1870s to connect businesses to the telegraph network, as explored in Chapter Six. Indeed, the two

³ Anonymous, 'Über das verbesserte Telephon', *DPJ*, 169 (1863), p. 399.

⁴ C. Beauchamp, 'Who Invented the Telephone?: Lawyers, Patents, and the Judgments of History', *Technology and Culture*, 51, no. 4 (2010), pp. 854–78.

technologies were initially conceived of as complementary, and together they fuelled the same expectations and disappointments which had manifested themselves throughout the nineteenth century. In March 1888, for instance, the *Münchener Fremdenblatt* was unable to print the new Kaiser Friedrich III's recent 'Proclamation to the Prussian People' because the editors had not been warned by telephone to expect its transmission by telegraph.⁵

By the 1880s, therefore, the 'motley tangle' of people and ideas involved with telegraphy, to which Heinrich Schellen had hoped to bring order three decades earlier, was all the more confused. Naturally, the widely circulating technical knowledge which underpinned the technology had been assembled in different ways by scientists, engineers and entrepreneurs. Electricity now belonged to the recognised fields of theoretical and applied physics taught at universities, engineering had found a space at the *Technische Hochschulen*, and telegraphy itself had become a subject of specialisation in certain polytechnical schools.⁶ Telegraphy as a form of communication, meanwhile, had been institutionalised in dedicated government departments, and had been defined as one of the crucial *Verkehrsmittel* which had triumphantly transformed German society and its economy. Behind this façade of rigorous categorisation, however, the 'hybrid' nature of telegraphy persisted, as the technology evolved, branched out, and continued to enrol an ever growing number of actors in its production and consumption.⁷

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⁵ BHStA, MV I 2069, *Münchener Fremdenblatt*, 14 Mar. 1888.

⁶ Anonymous, 'Die Telegraphie als Unterrichtsgegenstand an polytechnischen Schulen', *DPJ*, 217 (1875), pp. 156-7; W. König, *Technikwissenschaften: Die Entstehung der Elektrotechnik aus Industrie und Wissenschaft zwischen 1880 und 1914* (Chur, 1995), esp. pp. 12-111.

⁷ B. Latour, *Nous n'avons jamais été modernes: essai d'anthropologie symétrique* (Paris, 1991), pp. 7-22.

As this thesis has argued, from its origins, telegraphy was part and parcel of the reconfiguration of state and society in Western Europe, which had taken place since the sixteenth century. It emerged over the course of the nineteenth century from numerous existing ideas and practices of communication which sought to redefine the relations between individuals, the collectivities which they formed and the abstract states designed to contain them. The telegraph, as an object, was the product of interaction and cooperation between actors brought together by their shared interest in facilitating long-distance communication, each supplying the intellectual and material resources which were combined to reach their goal. As they collaborated, wittingly or not, they progressively established the boundaries distinguishing their respective spheres of expertise, authority and financial involvement in the project.

As a tool of communication, the telegraph itself came to multiply the connections between individuals, allowing for the formation of new social and economic relations. By facilitating the exchange of information over both long and short distances, the telegraph created new possibilities for the coordination of activities, locally, regionally, and beyond. It is this coordination which was at the heart of new structures of production, of wealth distribution, and of social interaction which have been subsumed under the terms of industrialisation, market capitalism, class, and arguably even nation. As such, however, it also necessitated the delimitation of individual responsibilities, competencies and functions within these groups and processes. As a structure of coordination, the telegraph was part of a much greater process of growing modern interdependence, manifested by interaction and differentiation.

Viewed from this perspective, the development of telegraphy reveals the connections between many of the themes which feature centrally in the historiography of nineteenth-century Germany. Science and technology emerge not as distinct fields of inquiry, but as the product of experimentation and analysis conducted by individuals in academic institutions, polytechnical societies, and government offices. Industrialisation did not entail the disappearance of 'traditional', regional, forms of manufacturing in favour of concentrated factory production, but a slow adaptation to new opportunities for the acquisition and distribution of materials at a distance. Stock trading did not sweep away private banking practices, but took advantage of the same international markets and networks of exchange. Telegraph networks provided a support structure for existing economic interactions, but also enabled them to be configured in new ways.

As a result, the telegraph underpinned the formation of the social groups and communities associated with these processes. The individuals involved in trade, finance, and manufacturing formed a *Wirtschaftsbürgertum* dependent upon the networks which the technology sustained. But the different uses to which they put the telegraph, the various activities which it enabled them to coordinate also revealed the divisions within their class. As users of the network became more socially diverse, alliances could be made which cut across this class, based on shared experiences of time and space. Local communities too, felt the impact of technological change. Conflicts over access to the telegraph highlighted the different directions in which a town's inhabitants were being pulled by the forces of socio-economic change. But the network also provided them with a means of re-ordering communal relations.

The lens of telegraphy thus reveals some familiar patterns in the course of nineteenth-century German history, but it also explains the many social, economic and

regional variations which historians have identified within them. ‘Traditions’ were not swept away by modernity, but given an additional framework in which they could be rethought and reconfigured. German institutions, intellectual currents, and socio-economic peculiarities of the early nineteenth century constituted elements which were combined afresh as the decades wore on.

As explored in Chapter One, the objective of rapid long-distance communication had long been on the horizon in human history, but by the late eighteenth century it had become closely associated with the optical telegraph. By the 1830s, knowledge of the technology’s benefits had become widespread among governments, intellectuals, and even the public. Encouraged by the example of the French network begun in the 1790s, and in particular the construction of a Prussian line between Berlin and Cologne in 1832, German writers, scientists, technicians and state officials turned their attention to the prospect of telegraphic communication.

Brought together by this broad horizon of expectation during the 1830s, their interest in the technology was drawn from different quarters. Like other intellectuals at the time, Friedrich List and Robert von Mohl recognised the importance of *Verkehr* as a means of exchange between individuals which formed the basis of economic life. They had adopted the tenets of Smithian theories, and believed that the satisfaction of human, material needs was at the root of all social interaction, but the legacy of Cameralism which they had inherited led them to see the economy as subordinate to the structuring power of the state. They saw in the telegraph a tool which could emancipate the ‘general interest’ from the clutches of the state, but remained true to their heritage and insisted upon the government’s right to regulate its implementation.

As Carl Gauß pursued his research into the earth's magnetism, meanwhile, his past interest in optical telegraphy remained diffusely on the horizon. Collaborating with Wilhelm Weber, he turned his attention to the influence of electricity as a means to attain that goal, discussing the idea with his colleagues and the young researcher Carl Steinheil in particular. Together, these scientists depended upon networks of correspondence which had long supported the diffusion of knowledge among intellectuals in the 'Republic of Letters'. Through these networks, they were able to conduct and discuss the empirical research which was no longer anchored in academies, and had not yet found a home in German universities. The collaborative nature of their work eludes linear narratives of scientific or technological discovery, and persisted even as their ideas were progressively assigned to an emerging discipline of physics.

The governments of Prussia, Austria and Bavaria, for their part, had long been aware of the strategic function of optical telegraph networks, and followed developments closely. Technology was only then experiencing a rehabilitation in military departments still tied to visions of traditional warfare, however, and notwithstanding the personal interest of individuals such as the Prussian Major O'Etzel in the matter, electrical telegraphy received considerable impetus from civil society.

As these actors addressed the task of reaching the goal ahead of them, it became clear that collaboration would be necessary in order to bring together the financial, technical and logistical resources required to materialise their ideas. Gauß and Steinheil were both keenly aware that the expectations fostered by the prospect of telegraphic communication could be leveraged to gain support from state or private actors. Whilst the former sought to collaborate with the Leipzig-Dresdner Eisenbahn-Compagnie, the latter petitioned the Bavarian *Akademie der Wissenschaften*, and then the government

for assistance in carrying out his trials. As German railway companies followed the example set by the installation of Charles Wheatstone's telegraph along the Great Western Railway in 1838, and turned to the technology as a means of signalling, governments were drawn further into this web of interactions, seeking to define the relations between the state and the private sector.

A productive tension reigned during the 1840s, as scientists, businessmen and officials collaborated to develop the technology, but simultaneously sought to assert their expertise, interest and authority in the process. Chapter Two illustrated the friction which emerged in Bavaria between the state, the München-Augsburger Eisenbahn-Gesellschaft, and the academic, Steinheil, as their ambitions for the technology diverged. German governments' direct interest in the technology waned when its utility for administrative purposes was called into question, but they remained attentive to its progress as it became identified with the railway industry and the new capitalist class which appeared to threaten existing structures of authority.

Telegraphy had thus further stimulated the tense but productive interaction of the state and private enterprise which characterised early German industrialisation. The tension was particularly stark in the dynastic states of Austria, Prussia and Bavaria, whose strong bureaucratic structures struggled to accommodate independent economic forces. Their interaction continued, however, as railway companies, governments and even Steinheil recognised their mutual dependence upon the resources which each could provide. Without the railway companies, the Prussian authorities recognised, the state would possess no telegraph lines; without the permission and support of the state, the companies themselves would be deprived of a technology which promised to revolutionise the efficiency of their services. In Bremen, on the other hand, where

commercial and political interests were closely aligned in the governing institutions of the *Handelskammer* and *Senat*, this tension was largely absent, but a lack of enthusiasm for the technology stalled its development. Across Germany, therefore, both expectations and collaboration were necessary ingredients in the process, but they had become the source of frustration.

Underpinning these interactions was a widespread diffusion of ‘useful knowledge’ across a broad landscape of innovation. Scientists’ networks were infiltrated by budding technicians and entrepreneurs, and indeed officials themselves, as the knowledge market became increasingly open during the 1840s. German governments were informed of trials and innovations through the press, made use of diplomatic connections to obtain details from abroad, and interacted with amateur or professional innovators who applied to state departments such as the Prussian *Technische Deputation* for intellectual property protection. These connections between state and society were supported by journals, which provided a forum in which the information essential to making important technical decisions could be discussed by all the parties concerned. It was by exploiting the social networks between these hubs and agents of innovation that the Prussian lieutenant Werner Siemens was able to make his mark in the field.

By 1847, however, the development of the technology had reached a crucial juncture. As discussed in Chapter Three, from a logistical perspective, it was now understood that the telegraph could serve both mundane functions for railway operations, and as a means of ordinary correspondence. From a technical perspective, therefore, the telegraph now required different forms of expertise. As the prospect of establishing communications networks came closer to reality, moreover, governments

sought to establish their control over the technology, and to set formal boundaries to the interests of the railway companies. Technical distinctions had thus sharpened the antagonisms between the state and the private sector.

In Austria the government clearly distinguished between state and railway telegraph lines, but in Prussia the terms under which concessions might be made to railway companies for these purposes were still being debated. In the heat of political conflict between the state and liberal proponents of a constitutional regime, the Prussian government reluctantly acknowledged its reliance upon private initiative for their construction, whilst the companies turned to the state for support in times of economic difficulty. The cooperation required in developing the telegraph had thereby provided a further bridge between the state and the private sector. In Bavaria, meanwhile, the state had nationalised its railway lines, but was trapped by its own commitment to the protection of intellectual property, and the *Privilegium* it had granted to Carl Steinheil. Only in Bremen, indeed, had the smooth alignment of private and state interests allowed for the establishment of a private telegraph company, working for the benefit of the local merchant community as well as the *Senat*.

The consequences of the 1848/9 revolutions brought an end to the deadlock which had emerged, as illustrated in Chapter Three. Across Germany, the geopolitical reconfiguration which took place when a National Assembly was convened in Frankfurt am Main determined governments to cut through the Gordian knot of the production process, and to assume responsibility and authority for the construction of telegraph networks. Immediately, however, they were confronted with an additional form of dependency, as inter-state agreements were necessary to the building of lines across

state borders, even threatening to dissolve the alignment of economic and political interests in Bremen.

At a time of political instability, the negotiation of such agreements was coloured by the restructuring of German space taking place in the National Assembly. The conduct of negotiations between states revealed that the provisional *Reichscentralgewalt* held more sway than is usually assumed, and served as a crucial mediator between the different states and regional power blocs within Germany. Once the National Assembly was dissolved, the larger states appeared to recover their freedom of action, but consumer demand reared its head, signalling that they would now be subject to pressure from the networks' customers.

The drafting of the constitution in the Paulskirche, meanwhile, had produced the first systematic consideration of the position to be attributed to telegraphy among other means of communication. Under the influence of the National Assembly's *volkswirtschaftlicher Ausschuß* in particular, the text projected that a future national telegraph network would primarily serve the economic needs of society. Marking a victory for liberal economic principles, the text set an example for decades to come. Communications networks had been recognised as a state monopoly, but had also been liberated from their fiscal functions. Economic growth, rather than profitability, had become their primary purpose, to which the state was to cater.

From the 1850s onwards, as argued in Chapter Four, use of the technology itself came both to reflect and fuel the socio-economic transformation of Germany. Like its neighbours, Bavaria found itself caught in an expanding German and European network, structured from an early stage by the *Deutsch-Österreichischer Telegraphen-Verein*, which placed pressure upon each state to expand its network. Throughout the

following decades, the mutual dependence of international telegraph networks continued to encourage cooperation but also to produce tensions between states, particularly as the extent of networks grew to encompass entire continents and eventually, the globe.

Pressures from without were matched by demand from within, as the telegraph became a support structure for industrialisation and market capitalism. The government's hopes of planning and building a carefully managed network were soon dashed, when the economic functions of the telegraph were emphasised by liberal deputies in parliament, and the state found itself serving the ever-changing needs of a small but economically active community in its commercial and manufacturing centres. Connecting financial hubs, news agents and editors, as well as merchants in towns across Germany and beyond, the telegraph facilitated the expansion of market capitalism. However, it did so by strengthening the long-distance relations which already underpinned private banking practices, whilst tying together cities engaged in different forms of capital mobilisation. Traditional centres such as Augsburg and Frankfurt, for instance, participated in a market which now included Berlin and Elberfeld, more attuned to the needs of stock trading in new industries.

In a similar way, the network provided a structure using which pre-existing manufacturing sectors were able to coordinate their activities of production and distribution - of particular importance in the 'decentralised' regions of south-western Germany. Finance and industry were now part of the same circuit. The textile producing regions of Bavaria and Prussia, for instance, were placed alongside the merchant *Hanse* cities and the banking and financial hubs of Vienna, Frankfurt, Augsburg and Berlin, establishing channels of influence for the rising *Wirtschaftsbürgertum*. At the same

time, however, the stakes were all the higher for those excluded from this privileged network - the telegraph introduced a process of 'de-synchronisation' between those sectors benefitting from rapid communication and those relegated to a slower pace of life. The exclusiveness of the new commercial bourgeoisie was thereby accentuated.

It was by observing both the advantages and patent limitations of telegraphy that Karl Knies revisited contemporary concepts of communication, in *Der Telegraph als Verkehrsmittel*. Rather than accept the universal laws of economic interaction which were at the heart of Smithian theories, he sought to investigate their validity. Beginning with the individual as an agent pursuing the satisfaction of material needs, he analysed the concrete impact of the means of communication upon the attainment of that goal. Recognising that the brevity of telegrams made it primarily suited to business transactions, he searched for a concept which would avoid reducing communication to an 'egoistical' activity, of the kind which classical economics appeared to promote, and which he and his contemporaries began to see as the cause of increasing social unrest.

Knies turned the telegraph's weakness into an advantage, and suggested that telegrams were therefore to be sent and received like nervous impulses by all of the network's nodes and further diffused by means of the press and 'associative consumption'. The technology would thereby enable individuals to share in a sense of 'common destiny' rather than merely pursue economic gain. Foreshadowing changes in intellectual thought over the decades to come, he had placed communications technologies at the heart of both economic and social theory.

By the 1860s, Chapter Five suggested, liberal economic principles had been accepted as the basis for the development of communications infrastructure. Pursuing the aim of facilitating unhindered exchanges within society, however, the Bavarian

administration sought to create a ubiquitous network, which no longer privileged only the hubs of commercial activity. Secondary branches extended the telegraph's reach into the countryside, situating agriculture and peripheral regions of manufacturing within the network alongside the economic heartland. For practical reasons, providing a ubiquitous service necessitated the adoption of new organisational concepts, which took account of the fluctuations in telegraphic traffic in different places, at different times. Knies' vision of a network of nerves thereby gave way to one of organic blood flow, carrying telegrams across a system of 'arteries' and 'mere veins', its rhythms coordinated according to the official, standard time zone of the network.

The process resulted in a further, more subtle form of exclusion and inclusion, however. Temporal hierarchies emerged between the different users of the technology, some urban offices being given longer opening hours than others, or access to more capacious lines within the network. Distinctions within the economic sector thus reappeared in a new form, and towns or regions moved ahead or fell behind others, depending upon the speed of their connection. At a local level, moreover, divisions were highlighted within the *Wirtschaftsbürgertum*, as single telegraph offices were expected to serve the diverse needs of elites within communities. The configuration of local space according to the forms of business in which they engaged, whether finance, trade, or manufacturing – as well as administration – was spotlighted.

By the time the Kaiserreich was established in 1871, it was in no position to fundamentally alter the structure of telegraphic communication. Chapter Six demonstrated that the new imperial state was caught between the internal demands of its constituent states, railway companies and population on the one hand, and the international dimension of telegraph networks, including the ambitions of global cable

companies, on the other. The federal nature of the German nation-state was accentuated by the *Reservatrechte* which granted the governments of Bavaria and Württemberg the authority to manage their own networks, whilst all states also remained at the mercy of demand from their own populations in their attempts to run efficient and viable, if not profitable networks. Whilst the early years of the Kaiserreich witnessed growing tension between government and parliament, Reichstag debates surrounding the telegraph provided occasions for alliances across the party lines traditionally identified at this time.

In the course of these discussions, deputies drew attention to the divisions which had emerged between users of the telegraph over the preceding twenty years. United in their denunciation of the financial elite associated with both the *Gründerkrach* and the speculation facilitated by the telegraph network, they highlighted the different economic values of distance. Calling into question the ability of the technology to ‘annihilate’ space, they demonstrated that place had become all the more important to different sectors of the economy. Agriculture and small-scale enterprise allied against *Großhandel* and *Großindustrie* in their dependence upon more local ranges of communication. Other constellations also formed around the value of distance however, and workers or artisans were seen as sharing the same communicational horizon as agriculturalists, for instance. In the process, therefore, the social dimension of communication had become salient, and it is within this context, that Heinrich Stephan promoted his vision of a universally accessible, socially inclusive network. As a means of communication, the telegraph thus directly connected economic and social issues, and Stephan’s measure in many ways established principles which would give rise to the *Sozialstaat* of the 1880s.

In concrete terms, the 1870s witnessed extensive construction projects in Germany, expanding the telegraph network's reach to all towns of over 2,000 inhabitants, and in practice, smaller ones too. Telegraphy infiltrated the sinews of everyday life, potentially serving as a means of communication across any distance, but also providing other services, such as weather forecasting, clock synchronisation, and fire warning systems, which brought predictability and security to many towns and villages. In the process, however, the communal offices around which the network was structured were pulled in many different directions.

To the divisions of the *Wirtschaftsbürgertum* which had become apparent in the 1860s were now added the broader social composition and distribution of local communities. As administrations sought to improve local access to the service, multiple telegraph offices were established for different sections of the population. The financial elite, and the *Börsen* in which they congregated, were repositioned in urban networks whose central hubs were moved to new, more inclusive locations, and new offices opened in the outer districts populated by manufactures and their employees. The result was a physical entrenchment of social divisions in the urban environment, but a symbolic re-orientation of local communities within the network. By the end of the 1870s, individuals were seeking tailored access to a network through which all could be connected, but using which they could pursue their distinct interests.

Throughout the course of its development between 1830 and 1880, telegraphy thus epitomised the ambiguities of a Western modernity shaped by the growing interdependence of people and places. The ideas pursued by the mathematician Gauß, for instance, would no doubt have remained fruitless without the collaboration of the physicist Weber, or his knowledge of the available literature on the topic. Having

communicated with Gauß on the subject, Carl Steinheil's experiments in telegraphy would not have been possible without the financial assistance of the Bavarian government, and the materials provided by the München-Ausgburger Eisenbahn-Gesellschaft. Progress would most probably have stalled, had it not been for the example set by Charles Wheatstone's installation of a telegraph apparatus along the Great Western Railway. The chain of dependencies which had thus been created did not stop at the boundaries of 'science', 'technology', or 'the state'.

It was the multiplication of such connections, however, the combinations and permutations of actors involved in the process of innovation that revealed where those boundaries lay. Only by interacting with the railway company concerned, for instance, did Steinheil discover the limits to their interest in his scientific experiment; only through his negotiation with the state did he acknowledge its power to protect his intellectual property, and did the administration recognise its lack of expertise in the matter. Greater interaction implied greater differentiation.

The telegraph encouraged this process, by facilitating communication between ever growing numbers of actors. It is no coincidence that industrialisation and market capitalism flourished under its aegis, as two forces which were inherently the product of exchanges and dependencies. The telegraph offered the gift of coordination. Along with roads, canals and railways, it facilitated the transportation of goods and accelerated the process of buying and selling which made individuals interdependent across greater distances.

On the other hand, it made clearer the distinctions between them. From price differentials to inequalities in resources, the network provided a framework within which such comparisons could be made. Access to the telegraph, therefore, supplied one

among many modern means of distinguishing the commercial bourgeoisie from other social groups, but also established divisions within the class itself. Over time, similar amalgamations and distinctions emerged between and within other social strata, and were expressed in the reconfiguration of local communities.

The analytical lens of telegraphy naturally also blurs other details in the picture. The findings and arguments put forward in this thesis do not account for differences between the telegraph and other ‘revolutionary’ technologies of the period. The construction of railways, for instance, required the mobilisation of much larger amounts of capital and enrolled other actors not present in this thesis. Moreover, the experience of telegraphists, messengers and other faceless participants in the technology’s development is particularly difficult to access through the available archival material.

The parallels drawn between business practices and religious affiliations ever since the publication of Max Weber’s *The Protestant Ethic and the Spirit of Capitalism* in 1904/5, meanwhile, constitute a further terrain for possible inquiry. For instance, the simultaneous emergence of distinctive religious milieus in Germany during the era of the *Kulturkampf*, and of much broader religious ‘internationals’ which made use of modern means of communication to mobilise the faithful across the globe, was intimately related to new technologies of long-distance communication.⁸ An analysis of the direction taken by telegraphy once it became a tool of mass communication would also be a particularly interesting means of testing the arguments presented, but it lies beyond the chronological scope of the present work.

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⁸ A. Green and V. Viaene (eds.), *Religious Internationals in the Modern World: Globalization and Faith Communities since 1750* (Basingstoke, 2012).

This thesis has argued that the development of telegraphy in Germany was embedded in a much broader historical narrative of modern communication, which reaches further back than the nineteenth century and projects forward beyond the present day. There were no ruptures, knots or additions in this thick historical continuity, rather its threads and filaments were further separated and then intertwined in new ways. Despite the apparent irruption of telephony in the late nineteenth century, indeed, telegraphy was only then primed for ‘take-off’. In 1930, over 31 million telegrams were sent and received in Germany, and only in 2013 was the last telegram sent, worldwide, from India.⁹

Everything remains of the process from which telegraphy emerged and to which it contributed, however. New media have taken on the role of facilitating communication, and the long-awaited ‘death of distance’ remains firmly on the horizon, but it is the same growing interdependence of people and places which they serve.¹⁰ The ambiguities which result from this process are experienced daily, as the triumph of new connections is matched by despair at new inequalities, and a reluctant admission of incomprehension vis-à-vis the apparent autonomy of the forces behind them. It is only through our interactions across expanding networks that these similarities and distinctions become apparent, however, and that our hopes and disappointments are manifested. Together, they form the symptoms of modernity.

⁹ *Statistique générale de la télégraphie dans les différents pays de l’ancien continent* (Bern, 1932), p. 2, ‘ITU Historical Statistics’, accessed 22 Mar. 2017, at

<http://www.itu.int/en/history/Pages/HistoricalStatistics.aspx>; K. Westcott, ‘Telegram Era ends Stop’, BBC Article, accessed 20 Feb. 2017, at <http://www.bbc.com/news/blogs-magazine-monitor-22953657>.

¹⁰ F. Cairncross, *The Death of Distance: How the Communications Revolution is Transforming our Lives*, 2nd edn. (Boston, 2001).

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