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# The Development of Telegraphy, 1870–1900: A European Perspective on a World History Challenge

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Abstract

This article puts forward that the study of so-called information societies and of the interplay of information technology and society in general needs to be amended from a historical perspective. Only by looking back further than the 1960s can the concept of an *information revolution* be critically evaluated. I argue that the study of information societies must at least go back until the invention and spread of electric telegraphy which has brought about the detachment of telecommunication from transport and thus created a virtual space of information. The essay seeks to provide some initial empirical findings in order to facilitate the identification of regional case studies with different degrees of global connectivity. Statistical data from the ITU archives in Geneva has been collected and indexed in order to illustrate how different regions in Europe and the wider world developed in telegraphic terms between 1870 and 1900. It is hoped and anticipated that these initial findings will be refined and shall eventually provide the structural basis for detailed historical comparisons between regions with different points of connection.

## *Introduction*

Being part of what is still commonly referred to as Western societies, it is safe to say that information technology surrounds us. During the last decade and a half this assertion has become such a truism that a re-narration of how our lives are constantly influenced and reshaped by the promises and the demands of information technology is obsolete. After all, this article has been published in an online journal and you might even read it on screen saving on the print-outs. Therefore it is reasonable to assume that you, esteemed reader, are part of a global information network yourself – at least at the receiving end, probably also contributing to the information flow yourself – and that you thus are well-acquainted with the effects that such digital interconnectedness has on perceptions of space and time through the seeming annihilation of constraints of both.

The changes and innovations associated with the spread of modern information technology go beyond our individual experiences and have long since started to substantially transform their carrier societies. Concepts and terminologies such as *information age*, *information society*, *network society* or *informationalism* have been developed in order to describe and systematise the information technological development and its social, cultural and economic impact since the 1960s. For obvious reasons sociologists have been at the forefront of such analysis and theory-building. Scholars such as Daniel Bell[1] or Manuel Castells[2] have contributed substantially to our better understanding of contemporary societies and the role information technology plays in them. While different terms – such as post-industrialism or informationalism – have been coined to grasp the essence of the transformation that contemporary developed societies currently go through, they share at least one conviction: that the traditional (industrial) mode of production in such information or network societies is gradually replaced by an alternative model of labour (and general social) organisation. This transition is both a consequence as well as a motor of globalisation. It depends on a global division of labour which manifests itself in the pattern of a network of global contacts and interactions. This general network consists of at least three independent but interrelated parts: the global networks of migration, trade and communication. The study of all three of these is necessary in order to fully understand the process of globalisation. However, advances in modern information technology have largely detached the transmission of information from the movement of people and goods. IT-based networks operate and evolve differently from their migration and trade counterparts.

Access to information technology and accordingly access to information is unevenly distributed among but also within different societies. This inequality has often been subsumed and described as an existing *digital divide* between people (or regions) with high and those with low or no global connectivity. Although the question of how this divide can eventually be closed is still far from being resolved, it seems absolutely clear that societies at different sides of the divide stand different chances in the process of globalisation and global labour division. Well-connected, developed societies control the global information flow, less well-connected regions are often relegated to information consumers with only limited powers of contribution, while others seem to be almost completely excluded from the network.

Although the *digital divide* in its current form is a contemporary phenomenon, it is not without its own history. The early telecommunication networks of the nineteenth century have featured very similar integration gaps. These networks served particular administrative or commercial purposes and evolved accordingly – bringing some regions of the world very close together and at the same time (at least relatively) separating other regions. A historical study of the possible causalities and interrelations

between the socioeconomic development of a region and its position in the global communication network, will certainly contribute valuable background information to the discussion of contemporary inequalities. Although many historians seem to agree that that the question of how information technology and global telecommunication networks impact on societies is not a new one and that we will have to look back way further than the 1960s if we want to properly tackle this question,[3] the contributions to this field remain few.

## *Telegraphy and World History*

With this article I suggest that the study of our modern-day information societies must start with the invention and spread of telegraphy.[4] World Historians, who are looking for larger patterns in the process of globalisation and global networking, will find that the so-called dematerialisation of telecommunication – which first occurred on a significant scale with the advent of electric telegraphy – has established many of the parameters within which global telecommunication networks still operate today. Obviously, telegraphy – be it in its optical or in its electric variant – does not mark the first appearance of information technology in the sense of the word. Technical tools used for the transmission of information between individuals or societies are much older than that. Drums or other pre-historic musical instruments may constitute some of the earliest examples. But at least with the use of tools to engrave symbols into or paint onto carrier material, humankind witnessed the advent of information technology.[5] Ever since then human societies have been information societies in one way or the other and relied on information transmission beyond mere interpersonal face-to-face communication. So, why use the development of telegraphy as the starting point for a study of modern information societies?

Telegraphy marks the technological detachment of complex (tele)communication from transportation. Although communication systems based on acoustic or visual information transmission – such as fire beacons or drum and smoke signalling – had been in use for millennia,[6] only the development of telegraphy eventually allowed for the dematerialised communication of flexible, non-pre-arranged messages over large distances. With the help of both technological advances in the handling of electricity and the systematic improvement of the codes used in the process, complex contents now travelled faster than any known means of transport ever could. It was this detachment of communication and transportation that created a virtual space of information and information flows that did not need physical[7] presence or movement and thus freed communication from many of its former limitations.

The concepts of virtual space, cyberspace or even of Manuel Castells's *Space of Flows*[8] (all with their different emphasises and perspectives) are

complex ones and – partly due to their very virtuality – remain hard to pin down in their exact meanings and extent. One quintessential element that they share, however, is the notion that virtual space is detached from 'real' space and is reigned by slightly different physical and psychological rules brought about by the dematerialisation and the codification of information. In virtual space the traditional relation between time and space is tilted. So, virtual space does not bring or enable communication-transportation detachment. Quite on the contrary, it is itself a product of this development and impacts on 'real' space wherever they share agents (in the sociological sense of the word).

An early – pre-Internet, that is – example for what has just been said can be identified in the transformation of business methods through the creation of a virtual information space or, put more plainly, through the advent of overseas telegraphy in the second half of the nineteenth century. For the first time ever, European merchants or merchant houses enjoyed the luxury to communicate with their ships once these had left their European harbours. Market information about, say, coffee harvests and prices in South America was wired to Europe and local agents (now in the business sense of the word) of the merchant houses were provided with European demands and desires. All this created a virtual space of market knowledge relevant for the further course of the ship. Which coffee quality was in highest demand in Europe at the moment? Which regions enjoyed good harvests and sold cheaply? And, therefore, which port should be approached? Such information was prone to last-minute changes. In the virtual information space made possible by international telegraphy however such changes were processed quickly and transmitted across the globe without having to obey the rules of physical movement. International trade in agricultural products became more predictable, risks became calculable.[9] In the words of economists, the additional information available made the market a little more perfect.

Virtual space and 'real' space in our example intersect at two points: the European merchant house that receives and processes market information and decides what and where to buy and sell; and the local agent who gathers and sends market information to Europe, receives commands and directs the actual buying (and maybe selling). Throughout most of the nineteenth century the chief architects of our virtual space have been Europeans and Americans. The technology of telegraphy had been invented in the West and the layout of national and international telecommunication networks was geared to the needs of Western colonisers, businessmen and soldiers. The domestic telegraph networks which provided the essential link between the global information flow and the local agent outside the metropolis developed very early here and were tightly woven. Therefore, many of the principal constructors of and agents in international telecommunication networks have, for a long time, been of European or American provenance. Non-Western agents, however, have

not been excluded from virtual space – although their influence on the actual structure of the networks seems to have been limited in the early days of telegraphy. Even in uncolonised/decolonised territories such as China or South America Western-owned companies erected the first telegraph lines and thereby widened or narrowed the borders of virtual space. It goes without saying that local governments and interest groups eventually started to get actively engaged in the promotion of telecommunication as well and contributed their share to the structure of the network. But even today the shape of virtual space reverberates Western interests and agendas. It will therefore be a key question of further studies into the matter how local (Western or non-Western) agents utilised, acquired and transformed this new space and geared it to their own needs. How did their position in virtual space eventually influence their place in real-life globalisation?

I do not want to overuse the concept of virtual space here. What was actually happening in our specific example (and in many others) can probably be expressed in less abstract terms. After all we are talking about faster, more direct and interactive international communications. However, I have introduced the concept of virtual space, because it demonstrates neatly what must be understood by the terms *dematerialisation* and *detachment*. The detachment of communication from transportation indeed created two separate spaces, each with its own set of physical rules. Time and space relations are differently balanced in both realms. The concept is especially useful when we zoom out and try to get the bigger picture. In our example, things move, or are moved. Ships sail or steam from here to there, goods are purchased, loaded, transhipped and sold. The information flow in virtual space – although obeying its own rules – still roughly moves along 'real' pathways. Its senders and receivers are identical with prime 'movers'. Communication impacts more or less directly on transportation. From a zoomed-out perspective, however, virtual space is less congruent with 'real' space. Communication does not always directly acts on matter. Much information impacts merely on other information. Not all of what is communicated is of immediate usefulness or practical application. That is to say, the structure of virtual space is often different from its 'real' counterpart. Different centres, different peripheries evolve. Decision-making rather takes place in the centres of virtual space.

Before we set the concept of virtual space aside for the rest of this study, let me add that its most important virtue lies in raising the following question: if virtual space evolves adhering to different physical, managerial, political, topographical rules, is there something like a feedback into 'real' space? Can virtual space influence or even re-shape reality? Or put more plainly: does technology transform society? And if so, how? This question aims beyond the obvious. It seems reasonably obvious that writing for instance – clearly an information technology – has transformed

and shaped societies. Our question, however, more specifically aims at underlying social processes – migrations, social mobility, structural changes in the labour force or changing patterns in business locations to name but a few examples. All these are processes that are closely associated with our so-called information age and need not be explained in this current context. But can they be observed earlier as well? Did the detachment of communication from transportation – i.e. the initial creation of a virtual space – already have similar effects? In short, did telegraphy impact on society in a form that can be compared to the Internet's role today? And how did local agents and local societies transform and utilise new network technologies to their own ends? These are the questions that should and hopefully will guide much of the historical work on information technology in the near future. There is much that we can learn about our current position in the so-called information revolution and about future directions from such studies.

This article seeks to make a first, albeit small, step towards a comprehensive study of the structure and usage of the nineteenth-century telecommunication network. While we obviously do know that well-developed regions such as Europe or North America occupied central positions and that other regions, for instance in Africa or Asia, were relegated to the network periphery, we still know little about the finer patterns. What exactly did the nineteenth-century communication network look like? Where can we identify regions or countries with a good information infrastructure? Who makes best (or at least most numerous) use of such infrastructure? Only if the general pattern of the global network has been established will we finally be able to start with an assessment of the importance of global connectivity for local development.

The establishment of this pattern is a grand task and here I can only contribute a first piece. This article will look at the development of domestic telegraphy in a number of countries – most of them European – between the years 1870 and 1900. Most of the data presented here is of a structural character and provides information on the internal telegraphic integration of a unit of study. Outgoing network connections are mostly – albeit not entirely – excluded from analysis here due to the nature of the data that informs this study. The focus, for now, rests on the domestic development of telecommunication – only one part of the global information network. The geographical emphasis in this article lies on Europe and individual European countries, but the discussion of their telegraphic development must be understood within a global structural framework. Again the existing data basis is at least partially responsible for this. On the other hand it seems worthwhile to demonstrate how differently developed even a small continent like Europe has been in terms of telegraphic integration. I hope that this study will in the first place be able to identify a suitable case study for a later, more detailed examination of their position in the global telecommunication network.

A manageable time span of thirty years between 1870 and 1900 has been chosen as the period of observation of this study. These closing decades of the nineteenth century constitute an excellent period of observation in the expansion of telecommunications. The novel technology had firmly taken root and had demonstrated its potential by 1870. The first important intercontinental connections had already been established and the network had received a first form. For this limited study, the completion of the first telegraph link circling the entire globe in 1902 marks a convenient and natural end. The focus on this particular period also allows us to ignore the role of telephony in global telecommunication for the moment as this technology only started to spread and change local telecommunication in the 1890s (and then only in the United States and Germany).

Historical comparison will help to highlight the actual feedback and impact the telecommunication network had on social processes. Such comparison can be differently applied, but the synchronous comparison of societies with different degrees of connectivity will certainly be one of the core constituents of a promising study. This also means that the identification and categorisation of communication centres and peripheries will be the first step that has to be taken. Here, only the topmost level of examination shall briefly be presented. Although even this crude approach is still incomplete and in need of extension, it does hint at how quantification can contribute to the answering of our guiding questions. However, before we come to this let me set the stage by commenting briefly on the history of telegraphy and the socioeconomic background of our research.

### *The Technological History of Telegraphy*

The study of the history of telegraphy is worthwhile for a multiplicity of reasons beyond its significance in detaching communication and transport. Telegraphy proves to be an excellent example to test several of the current axioms of the history of technology in general. First, the long story of telegraphy's invention supports the notion that there usually are 'no leaps' in the history of technology.[10] Indeed, electric telegraphy built upon the studies and the research of an incredibly large number of people in a variety of fields. Scientists such as Galvani, Volta, Faraday or Ørsted all made substantial contributions to our understanding of electricity without which the mechanisms behind electric telegraphy would have been inconceivable. Similarly, the design of early telegraphic apparatus often resembled the equipment used in pre-electric telecommunication. The ideas of clockwork mechanisms or moving needles were borrowed. In other experiments, telegraphs simply transmitted the letters of the alphabet in plain-text thus using a conventional but obviously unfit code system for a new technology. Incremental changes and a great adherence to

path-dependency distinguish the early history of telegraphy – and, as I suggest, remain important throughout its development. This notion is also supported by the obvious simultaneity of invention (and partly also of innovation) at least in the early stages of telegraphy. Researchers and inventors in very different parts of the world and only very loosely connected with each other achieved their telegraphic breakthroughs with differing systems but in great chronological proximity. After early designs by Samuel Thomas Soemmering (1809) or Francis Ronalds (1816), several fully functional systems were developed independently by Paul Schilling von Canstatt (1832), Carl Friedrich Gauss and Wilhelm Eduard Weber (1833) or Karl August Steinheil (1835). The two telegraphic systems that should finally catch on and diffuse into widespread use were both publicly presented in the year 1837 – by Samuel F. B. Morse in the United States and by Charles Wheatstone and William Fothergill Cooke in Great Britain. Such simultaneity in invention needs not necessarily be seen as an argument supporting notions of technological determinism as Robert Heilbroner in his by now outdated but still worthwhile article *Do Machines Make History?* puts forward,[11] but it certainly illustrates the role of continuity and path-dependency in the process.

The story of Francis Ronalds's telegraph also aptly exemplifies another important concept in the history of technology – *technological inertia*. The term has been coined by Joel Mokyr[12] and refers to the built-in stability of technological systems and their resistance to technological change. Such resistance can come from a variety of sources and follows different rationales,[13] but almost every technological innovation has encountered resistance. Obviously the technologies that prevailed and spread (and therefore had the chance to impact on society) have successfully overcome any such inertia. Many others – about which we know far less and which we therefore deem far less important – encountered severe resistance and never managed to become *technologies-in-use*. Ronalds's telegraph belongs to the latter category. In the year 1816 Francis Ronalds completed his clockwork telegraph and longed to put it to good use. He informed the Admiralty about his invention and elaborated on the many advantages of rapid communication between London and the major ports. Admittedly his telegraph suffered from several deficits, but it was in working order and would have speeded-up and facilitated telecommunication significantly. Alas! The Admiralty had no demand for Ronalds's telegraph and referred to the existing semaphoric connections between London and the ports as fully satisfactory for all practical purposes. Although this is rather difficult to verify, it is likely that Steinheil's perfectly working telegraph has suffered a similar fate due to the division of future Germany in a multiplicity of small political entities which lacked the ultimate demand for a centralising technology like the telegraph.

The successful spread of Wheatstone's and Cooke's telegraph owes much to the same mechanism. The railways in Great Britain steadily

created a field of practical application for telegraphy as the only means of communication faster than the trains themselves (and therefore useful in the coordination of train traffic). It has been the demand of the railway companies and various arising synergies that eventually helped to overcome *technological inertia* and rendered telegraphy a *technology-in-use*.

It has been convincingly argued by David Edgerton – first with his ten eclectic theses[14] and then recently in *The Shock of the Old*[15] – that only the study of such *technologies-in-use*, i.e. technologies that have made it beyond the initial stages of invention and innovation and have indeed diffused into widespread use, can answer our questions as to the socioeconomic and cultural impact of technologies. Edgerton himself asserts that such an observation might appear to be a mere truism,[16] yet most historical studies on technology still focus on invention and innovation. The case of nineteenth-century telegraphy is no exception. The stories of Messrs. Cooke and Wheatstone, Messrs. Morse and Vail and their various forerunners have been told over and over, but only rarely has it been tried to assess the socioeconomic and cultural influence of nineteenth-century telegraphy. Jeffrey Kieve's influential study on the telegraph's social and economic history marked a first step in such a direction and brought telegraphy in Great Britain under closer socio-historical scrutiny.[17] However, the focus rests more on how social and economic preconditions influenced the adoption and spread of telegraphy, and less on the reverse effects telegraphic connection had on developed regions. Annteresa Lubrano's work with the promising title *The Telegraph: How Technology Innovation Caused Social Change*[18] does little to fill this gap. Only recent studies by Gregory Downey and Aad Blok[19] have contributed significantly to our understanding of the socioeconomic impact of telegraphy in selected regions. And the transformative effects of telegraphy on international business methods has become the focus of several recent studies all of which employ a fresh and much needed *use*-centred perspective.[20]

These works represent a new and very worthwhile approach to the history of telecommunications and put their emphasis on *technologies-in-use* in David Edgerton's sense. However, as of now these individual contributions lack a common background and basic comparability. From, for instance, a World History perspective it is difficult to contextualise their findings due to the want of a more global or at least supra-regional comparative framework. The method of comparison between world regions is fundamental to World History research in general and in our particular case allows for a functional assessment of telegraphy. In the long run, the comparative method will help us to establish which impacts global interconnectedness had on its carrier societies and how exactly such effects came about. But before researchers can tackle these larger questions, we will have to find out what to compare exactly. Where can we locate communication centres and peripheries? This brief survey will provide some first suggestions of how we can go about this.

In order to separate telecommunication centres from peripheries, we can apply at least three principal methods to the statistical data stored in national and international archives. These methods differ substantially in focus, in detail and in their hunger for data. All of them are concerned with telegraphy as a *technology-in-use*, but they employ different approaches and measure different things. The first and crudest method enlists a national perspective and seeks to assess how deeply a country is penetrated by telegraphy. This approach is helpful as it relates otherwise incomparable absolute figures to the geographic extent and the population size of a country. It, thus, renders the development of telegraphy internationally comparable, while it suffers from considerable crudeness stemming from internal inhomogeneity and the use of rather undifferentiated data. This article employs such an approach and presents some initial findings in the following section.

The second approach focuses on the connections between individual regions and especially cities and seeks to establish a network pattern that clearly separates communication hubs and peripheries. To this end the direct telegraphic connections between network nodes at a given point in time must be processed with the help of Social Network Analysis software. The centrality and the so-called *coreness* of specific nodes can thus be measured.

Third, an analysis of the information flow within the network has to be conducted. While approaches one and two are primarily concerned with hardware preconditions, this step examines the actual traffic and the use of the hardware. Although both a network analysis of, for a start, the European telegraph network and a study of the information flow in nineteenth-century Great Britain (with a case study emphasis on London) are currently taking place, it is too early to include even preliminary findings here. It is anticipated that the particulars of these analyses and some first results will be presented in a research article later this year.

### *Centres and Peripheries in Europe: National Comparisons*

In Article 61 of the convention issued by the *Conférence Télégraphique Internationale* taking place in Vienna in June 1868 the signing parties decided to found a *Bureau international des Administrations télégraphiques* which would mainly be concerned with standardisation and compatibility in European telegraphic transmissions.[21] In the *Règlement de Service International* attached to the convention, the Swiss telegraph administration was authorised to organise the international bureau which was founded in Berne and eventually became the International Telegraph Union (ITU).[22] In order to facilitate the ITU's task, the telegraph administrations of the participating countries provided annual statistics on their telegraphic systems which were centrally processed, printed and distributed by the ITU. These *Statistiques Générales de la Télégraphie* are still held and accessible at

the ITU library and archives in Geneva.[23] The data compiled in these statistics informs the following analysis.

Despite the bureau's efforts to compile statistical data on telegraphy in the years preceding its own foundation, the available figures become reliable and comparable only toward the end of the 1860s. For our purpose, I have chosen the year 1870 as a starting point, drawing samples every ten years until 1900. This will allow us to follow telegraphic development over the course of thirty formative years. It is important to note that the figures presented here are not absolute. They are indexed with 100 representing the average of between fifteen and nineteen selected European countries.[24] Every year of observation has its own index based on the current European average. Therefore the data does not allow for a detailed analysis of how a particular country developed internally between 1870 and 1900. Rather the study emphasises intra-European comparability and seeks to highlight where we can find relative communication centres and peripheries in late nineteenth-century Europe and how such regions shifted over the years. Thus, as pointed out above, it is the main contribution of this analysis to find and identify regions and countries suited to serve as the object for later comparative historical studies.

In the year 1870, the ITU compiled statistical data for 23 administrative entities, of which 21 can be found in Table 1. The Indo-European telegraph has been omitted for reasons of limited comparability and Turkey has not been included due to the incompleteness of the available data. Table 1 clearly illustrates that large entities such as Russia or India have rightly not been consulted in the calculation of the index as their huge landmasses massively distort the outcome. Compared with the index they feature distinctly below the ten-percent mark in all evaluated categories.

Together with several smaller European countries, Great Britain evidently leads the way in network tightness and in the use of the electric telegraph. For the year 1870, no figures showing the total kilometres of telegraph lines in Great Britain were available, but in the ratio of length of wires per surface area Britain is surpassed only by Belgium – a compact and densely populated country. Also coming close to the British wire density, Baden is almost twenty times smaller in area than Great Britain. This illustrates how widely the British telegraph network had already spread across the relatively big area of the country. Switzerland, the Netherlands, France, Bavaria and Württemberg also boast a well-developed telegraph network. And even for all of what would soon be the German Empire (founded in 1871 only) the density figures are still easily above average. Austria, Italy and maybe Denmark revolve around the one hundred mark in terms of network density per area, while Spain, Greece, Hungary, Norway, Portugal, Romania and Sweden are distinctly underdeveloped in this regard.

The distribution of telegraph bureaus shows a very similar picture. Belgium leads the way in bureaus per area, but performs less outstandingly from a per-inhabitants perspective. As pointed out above, Belgium's high

 

**Table 1. Indexed data on network structure and use of electric telegraphy in selected countries, 1870 (selected European average = 100).**

| Country | Lines per Area | Wires per Area | Bureaus per Area | Bureaus per Pop. | Int. Mess. per Pop. | Ext. Mess. per Pop. |
|---|---|---|---|---|---|---|
| Austria | 96.47 | 113.71 | 83.75 | 84.25 | 60.93 | 90.93 |
| Belgium | 257.11 | 309.87 | 348.40 | 138.74 | 190.52 | 172.59 |
| Denmark | 86.95 | 84.04 | 87.99 | 126.50 | 83.97 | 210.03 |
| France | 138.44 | 141.85 | 137.58 | 127.75 | 90.71 | 52.02 |
| Germany[a] | 115.01 | 136.89 | 152.75 | 137.93 | 99.16 | 124.89 |
| Baden | 196.91 | 228.55 | 343.93 | 238.50 | 90.57 | 396.72 |
| Bavaria | 149.74 | 175.88 | 195.70 | 200.61 | 54.10 | 165.81 |
| North Germ. | 101.99 | 126.01 | 133.83 | 121.02 | 108.34 | 101.08 |
| Württemberg | 191.89 | 144.92 | 237.34 | 170.96 | 74.03 | 194.38 |
| Great Britain[b] | n.a. | 230.61 | 314.43 | 203.39 | n.a. | n.a. |
| Greece | 62.29 | 25.99 | 17.02 | 38.20 | 50.30 | 14.13 |
| Hungary | 59.15 | 64.51 | 40.03 | 51.50 | 58.97 | 11.67 |
| India | 9.97 | 6.06 | 1.08 | 1.48 | 1.66 | 0.40 |
| Italy | 103.96 | 113.00 | 86.31 | 65.91 | 50.51 | 38.00 |
| Netherlands | 158.99 | 199.44 | 164.57 | 96.44 | 207.32 | 254.92 |
| Norway | 34.23 | 18.52 | 10.42 | 118.25 | 108.22 | 131.03 |
| Portugal | 56.28 | 38.84 | 30.41 | 46.38 | 30.83 | 22.40 |
| Romania | 47.83 | 23.28 | 12.38 | 19.57 | 59.29 | 40.66 |
| Russia | 3.70 | 2.72 | 0.79 | 13.52 | 18.37 | 7.68 |
| Spain | 39.97 | 33.83 | 8.97 | 17.72 | 31.76 | 16.31 |
| Sweden | 25.78 | 23.79 | 14.96 | 103.51 | 68.69 | 68.59 |
| Switzerland | 217.55 | 172.44 | 304.47 | 327.35 | 308.80 | 251.84 |

*Source*: Bureau International des Administrations Télégraphiques, *Statistique Générale de la Télégraphie dans les Différents Pays de l'Ancien Continent, Année 1870* (Berne: Imprimerie Rieder & Simmer, 1873).
*Notes*: In the calculation of the selected European average for 1870 the following entities have been considered: Germany, Austria, Belgium, Denmark, Spain, France, Greece, Hungary, Italy, Norway, the Netherlands, Portugal, Romania, Sweden and Switzerland.
[a] Here, *Germany* is an artificial entity created for the sake of comparison. The sources for the year 1870 contain individual data for the North German Confederation, Baden, Bavaria and Württemberg only. The figures given for Germany have been compiled by adding up the figures of these four countries. Accordingly the values for internal and external messages are distorted in the aggregate figure for Germany as, for instance, a message from Baden to Bavaria would count as external.
[b] The size of the British population given in the ITU statistics for the 1870 was clearly incorrect. The figure for the year 1871 has been used here.

population density is the reason for this. Leaving aside small Baden, Britain follows suit with a bureau per area density of 314 – an impressive figure for a country of its size. Switzerland is not far behind and distinctly outperforms all competitors in bureaus per inhabitants. The later German Empire, France and the Netherlands also do very well, even if the densely populated Netherlands are only average in bureaus per inhabitants. Austria, Denmark and maybe Italy again form the midfield, while all others linger at the lower end of the spectrum.

 

As regards the number of internal and external messages sent and received per year, nothing reliable can be said about Great Britain in 1870 as only a cumulate figure for all messages has been forwarded to the ITU. Switzerland, the Netherlands and Belgium have the highest ratio of internal messages per head, while Germany, France, Denmark and Norway form the middle field. In external messages per head, the maritime-trading countries of the Netherlands, Denmark and Belgium lead the way. Only ubiquitous Switzerland and the future members of the German Empire boast a similarly high rate of international communication. In the latter case this can clearly be attributed to the fact that communication between the constituents counted as external in the 1870 evaluation. The sharp drop in the ratio that can be seen in Tables 2 to 4 proves this.

On the basis what has been observed so far, Great Britain, Belgium, the Netherlands, France, Switzerland and southern Germany can be identified as communication centres in 1870. Austria, Italy and Denmark level off around the average. While all other featured entities – among them, for instance, Spain, Hungary or Sweden – cannot compete with the above-mentioned in telegraphic development.

Table 2 shows a similar picture for the year 1880. The compact countries of Belgium and Switzerland still lead the way in network density per surface area. Among the bigger players, Germany and France have almost fully caught up with Great Britain in terms of telegraph lines, while there are still more wires in Britain. Austria, the Netherlands and Luxembourg also do very well. Denmark and Italy still form the midfield, while the other European countries and all non-European entities lag far behind. Switzerland, Belgium, Luxembourg as well as the Netherlands, Germany and Great Britain all outperform France in bureaus per area. France is almost relegated to midfield here together with Austria, Denmark and Italy.

If we eliminate white settler colonies such as New Zealand and Victoria with only rudimentary populations but relatively high development in certain key regions, Great Britain easily heads the internal messages per head ratio. This illustrates the widespread *use* of telegraphy in Britain. Only Switzerland is anywhere near. The Netherlands, France and Belgium follow next. And again, it is the maritime-trading countries together with the Alpine enclave of Switzerland who lead the way in external communication per head. Altogether there seems to have been little shift in communication centres and peripheries between 1870 and 1880.

Western Union – the quasi-monopolist telegraph company in the United States – is also included in the 1880 table. Interestingly enough it is far behind in all per-area categories, but performs very well in the one per-head category where accurate data was given.

Again, ten years later the general pattern remains, but several changes can be observed in the details. Still Belgium has the highest ratio of telegraph lines and surely of wires in the year 1890. Switzerland, albeit

**Table 2. Indexed data on network structure and use of electric telegraphy in selected countries, 1880 (selected European average = 100).**

| Country | Lines per Area | Wires per Area | Bureaus per Area | Bureaus per Pop. | Int.Mess. per Pop. | Ext.Mess. per Pop. |
|---|---|---|---|---|---|---|
| Alg. & Tunisia | 51.54 | 33.62 | 13.47 | 42.14 | 123.30 | 59.85 |
| Austria | 144.22 | 132.69 | 103.42 | 95.96 | 68.11 | 72.37 |
| Belgium | 235.15 | 385.67 | 318.63 | 115.94 | 167.19 | 201.46 |
| Bosnia-Herzeg. | 43.59 | 21.77 | 14.47 | 48.09 | 69.16 | 3.50 |
| Brazil | 8.63 | 4.38 | 1.69 | n.a. | n.a. | n.a. |
| Bulgaria | 41.70 | 21.45 | 6.27 | 13.32 | 33.64 | 19.55 |
| Cochin-China | 36.01 | 14.29 | 7.39 | 17.16 | 11.64 | 5.06 |
| Denmark | 110.67 | 103.09 | 86.76 | 117.97 | 106.83 | 260.63 |
| Dutch Indies | 4.57 | 2.03 | 0.61 | 2.87 | 6.55 | 2.01 |
| Egypt | 10.08 | 5.83 | 1.95 | 24.71 | 19.72 | 2.83 |
| France | 161.36 | 164.76 | 125.99 | 123.39 | 195.90 | 73.67 |
| Germany | 162.19 | 206.06 | 225.88 | 184.35 | 114.06 | 79.31 |
| GB & Ireland | 166.06 | 268.61 | 210.09 | 131.30 | 342.57 | 90.80 |
| Greece | 87.89 | 39.62 | 21.31 | 43.56 | 79.73 | 49.32 |
| Hungary | 55.82 | 70.38 | 37.56 | 53.72 | 46.91 | 65.20 |
| India | 9.75 | 9.45 | 4.24 | 4.97 | 2.58 | 0.99 |
| Italy | 109.55 | 125.93 | 95.36 | 68.50 | 84.36 | 32.43 |
| Japan | 21.60 | 17.29 | 6.24 | 5.12 | 23.22 | 0.54 |
| Luxembourg | 148.01 | 90.00 | 296.06 | 255.53 | 58.13 | 173.01 |
| Netherlands | 143.01 | 181.87 | 145.89 | 81.09 | 214.94 | 230.31 |
| New Zealand | 47.74 | 41.64 | 17.15 | 389.29 | 1226.16 | 40.47 |
| Norway | 33.69 | 21.81 | 9.51 | 110.72 | 119.87 | 135.52 |
| Portugal | 59.84 | 52.45 | 26.42 | 37.98 | 45.02 | 47.31 |
| Romania | 40.17 | 22.46 | 15.41 | 33.49 | 61.99 | 40.12 |
| Russia | 5.26 | 4.21 | 1.43 | 24.29 | 29.44 | 9.51 |
| Serbia | 55.31 | 27.97 | 15.48 | 30.31 | 40.82 | 26.64 |
| Spain | 40.11 | 35.09 | 8.75 | 18.00 | 43.07 | 23.21 |
| Sweden | 32.22 | 28.96 | 21.58 | 142.73 | 68.53 | 78.97 |
| Switzerland | 195.48 | 167.98 | 325.23 | 325.34 | 281.76 | 287.48 |
| Victoria | 28.16 | 18.64 | 15.11 | 272.35 | 610.09 | 8.78 |
| Western Union | 27.98 | 29.17 | 16.65 | 177.11 | n.a. | n.a. |

*Source*: Bureau International des Administrations Télégraphiques, *Statistique Générale de la Télégraphie dressée d'après des Documents Officiels, Année 1880* (Berne: Imprimerie Rieder & Simmer, 1882).
*Note*: In the calculation of the Selected European Average for 1880 the following entities have been considered: Germany, Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Denmark, Spain, France, Greece, Hungary, Italy, Luxembourg, Norway, the Netherlands, Portugal, Romania, Serbia, Sweden and Switzerland.

still in the top group, is slowly falling back. Germany and France have both overtaken Great Britain in lines per area, while Britain remains an extraordinary density of wires per area. Austria is losing ground to its fellow midfielders Denmark and Italy, while Greece seems to have invested heavily in the extension of the line network. It is also clearly

**Table 3. Indexed Data on Network Structure and Use of Electric Telegraphy in Selected Countries, 1890 (Selected European Average = 100).**

| Country | Lines per Area | Wires per Area | Bureaus per Area | Bureaus per Pop. | Int.Mess. per Pop. | Ext.Mess. per Pop. |
|---|---|---|---|---|---|---|
| Algeria | 11.19 | 9.12 | 4.76 | 53.65 | 112.67 | 7.53 |
| Austria | 88.02 | 86.18 | 100.38 | 91.25 | 56.67 | 85.43 |
| Belgium | 220.97 | 368.72 | 254.74 | 88.92 | 144.82 | 205.62 |
| Bosnia-Herzeg. | 53.16 | 39.76 | 16.06 | 44.35 | 24.42 | 59.98 |
| Bulgaria | 45.25 | 27.32 | 11.63 | 26.09 | 65.54 | 23.94 |
| Cochin-China | 10.01 | 5.49 | 2.36 | 15.46 | 15.56 | 4.86 |
| Denmark | 113.48 | 108.65 | 77.57 | 98.78 | 86.60 | 206.35 |
| Dutch Indies | 4.52 | 2.06 | 1.27 | 5.28 | 4.01 | 2.11 |
| France | 176.78 | 196.81 | 146.62 | 146.44 | 259.46 | 82.61 |
| Germany | 185.18 | 222.12 | 257.72 | 203.13 | 123.47 | 78.48 |
| GB & Ireland | 156.49 | 336.52 | 193.10 | 116.26 | 535.94 | 95.56 |
| Greece | 114.04 | 47.75 | 22.29 | 45.92 | 120.19 | 58.50 |
| Hungary | 56.67 | 51.30 | 45.58 | 61.19 | 43.95 | 51.80 |
| India | 16.34 | 17.54 | 6.96 | 7.03 | 3.81 | 0.91 |
| Italy | 116.93 | 120.46 | 108.36 | 78.08 | 80.85 | 25.07 |
| Japan | 32.58 | 32.59 | 7.19 | 4.95 | 33.44 | 1.16 |
| Luxembourg | 152.13 | 106.37 | 292.51 | 258.89 | 34.21 | 155.24 |
| Netherlands | 153.47 | 188.48 | 181.81 | 95.02 | 158.75 | 217.48 |
| New Zealand | 30.83 | 26.77 | 15.59 | 447.90 | 963.26 | 33.46 |
| Norway | 22.74 | 15.34 | 8.74 | 101.82 | 154.20 | 123.81 |
| Portugal | 73.62 | 55.66 | 35.07 | 52.95 | 57.59 | 74.18 |
| Romania | 33.15 | 25.08 | 18.95 | 43.49 | 63.48 | 36.43 |
| Russia | 5.19 | 3.61 | 1.38 | 20.54 | 26.71 | 6.93 |
| Senegal | 14.09 | 5.86 | 0.80 | 96.25 | 93.24 | 14.36 |
| Serbia | 58.76 | 34.71 | 19.64 | 31.93 | 75.65 | 26.85 |
| Spain | 48.36 | 37.71 | 17.95 | 37.09 | 59.96 | 29.41 |
| Sweden | 19.21 | 17.63 | 18.21 | 121.81 | 66.78 | 78.59 |
| Switzerland | 168.08 | 149.95 | 266.17 | 272.86 | 223.43 | 280.24 |
| Tunisia | 22.78 | 12.79 | 3.86 | 24.16 | 43.31 | 55.24 |
| Victoria | 27.35 | 21.00 | 25.65 | 419.56 | 856.13 | 206.13 |

*Source*: Bureau International des Administrations Télégraphiques, *Statistique Générale de la Télégraphie dressée d'après des Documents Officiels, Année 1890* (Berne: Imprimerie Gebhardt, Rösch & Schatzmann, 1892).
*Note*: In the calculation of the selected European average for 1890 the following entities have been considered: Germany, Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Denmark, Spain, France, Greece, Hungary, Italy, Luxembourg, Norway, the Netherlands, Portugal, Romania, Serbia, Sweden and Switzerland.

visible that Germany has managed to vastly expand its bureau ratio – per area as well as per head. It is now on par with smaller countries such as Belgium, Luxembourg, Switzerland or the Netherlands – a remarkable feat for a country of this size.

Still, the per-head amount of internal telegraphic messages sent and received is impressive in Great Britain. Eliminating New Zealand and

**Table 4. Indexed data on network structure and use of electric telegraphy in selected countries, 1900 (selected European average = 100).**

| Country | Lines per Area | Wires per Area | Bureaus per Area | Bureaus per Pop. | Int.Mess. per Pop. | Ext.Mess. per Pop. |
|---|---|---|---|---|---|---|
| Algeria | 14.66 | 12.21 | 4.59 | 43.29 | 119.66 | 4.42 |
| Austria | 95.31 | 89.59 | 96.38 | 83.81 | 85.41 | 86.59 |
| Belgium | 186.23 | 295.65 | 202.70 | 66.29 | 140.31 | 174.58 |
| Bosnia-Herzeg. | 48.13 | 37.20 | 12.95 | 31.93 | 29.82 | 83.18 |
| Brazil | 2.51 | 1.40 | 1.05 | 35.67 | 19.76 | 0.86 |
| Bulgaria | 45.34 | 28.17 | 12.32 | 24.46 | 74.92 | 17.27 |
| Cochin-China | 11.91 | 5.54 | 1.67 | 9.21 | 21.89 | 5.98 |
| Denmark | 86.55 | 91.45 | 68.41 | 81.26 | 76.62 | 217.54 |
| Dutch Indies | 3.94 | 1.73 | 1.17 | 5.01 | 3.31 | 3.09 |
| France | 224.78 | 250.71 | 129.05 | 135.99 | 300.94 | 71.63 |
| Germany | 203.36 | 222.21 | 239.57 | 173.95 | 163.05 | 77.22 |
| GB & Ireland | 200.58 | 448.86 | 193.47 | 112.48 | 565.85 | 92.58 |
| Hungary | 60.68 | 90.45 | 53.47 | 74.67 | 67.37 | 57.38 |
| India | 20.12 | 19.64 | 7.27 | 7.05 | 5.36 | 1.08 |
| Italy | 125.18 | 117.40 | 108.78 | 74.49 | 80.42 | 25.52 |
| Japan | 61.57 | 74.62 | 22.77 | 14.58 | 89.45 | 3.74 |
| Luxembourg | 202.26 | 101.84 | 346.49 | 287.85 | 44.44 | 198.00 |
| Montenegro | 47.30 | 17.48 | 11.12 | 28.04 | 54.67 | 24.50 |
| Natal | 35.84 | 27.11 | 14.30 | 99.02 | 1099.42 | 38.34 |
| Netherlands | 159.70 | 175.76 | 160.49 | 77.57 | 153.04 | 177.43 |
| New Zealand | 38.34 | 31.65 | 19.36 | 482.36 | 1341.08 | 52.77 |
| Norway | 31.93 | 32.87 | 13.65 | 154.45 | 178.57 | 137.31 |
| Portugal | 77.59 | 50.87 | 25.44 | 35.14 | 49.28 | 75.46 |
| Romania | 37.43 | 28.73 | 20.26 | 45.41 | 80.89 | 37.87 |
| Russia | 6.31 | 5.63 | 0.66 | 8.67 | 33.95 | 7.27 |
| Senegal | 7.68 | 2.71 | 0.72 | 11.84 | 23.85 | 2.94 |
| Spain | 55.13 | 38.02 | 15.63 | 32.77 | 58.70 | 22.89 |
| Sweden | 17.61 | 15.88 | 25.02 | 165.08 | 81.36 | 86.45 |
| Switzerland | 142.79 | 133.21 | 269.39 | 254.88 | 134.85 | 253.69 |
| Tunisia | 25.66 | 17.32 | 4.72 | 30.97 | 49.58 | 93.49 |
| Victoria | 38.81 | 23.92 | 10.35 | 148.85 | 359.99 | 87.99 |
| Western Union | 34.49 | 50.19 | 15.67 | 120.49 | 231.02 | 7.66 |

*Source*: Bureau International des Administrations Télégraphiques, *Statistique Générale de la Télégraphie dressée d'après des Documents Officiels, Année 1900* (Berne: Bureau International des Administrations Télégraphiques, 1902).
*Note*: In the calculation of the selected European average for 1900 the following entities have been considered: Germany, Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Denmark, Spain, France, Greece, Hungary, Italy, Luxembourg, Norway, the Netherlands, Portugal, Romania, Sweden and Switzerland.

Victoria, France and Switzerland come next, but do not even reach half of Britain's ratio. Although above the average, Germany lags behind its main competitors in this category and even performs way below average in external messages per head. Here, it is still the maritime traders and Switzerland who lead.

In the year 1900, the three big European nations Germany, France and Great Britain are almost level as regards telegraph lines per area. Belgium and the Netherlands have fallen behind. Switzerland has also constantly lost ground. France and Germany have both expanded their wire systems, while Belgium's, the Netherlands' and Switzerland's ratios have decreased. However, Great Britain is still in the unchallenged lead in this category. The bureaus per area ratio remains roughly stable among the big three, while the smaller, well-developed states slowly fall back in this category as well. Switzerland is the notable exception here. Germany maintains a density of bureaus per head which is unique among countries of such population size.

It is remarkable that all the big players are catching up with Britain in the ratio of internal messages sent and received. The smaller countries constantly fall back in this regard. The extraordinarily high figures of Natal, New Zealand and Victoria rather stem from their sparse populations than from unusually high telegraphic activity. The international messages are the one category where Germany, France and Great Britain still lose out against the maritime traders such as Belgium, the Netherlands or Denmark all of whom maintain a high ratio of external messages sent and received per head.

### *Conclusion*

Which conclusions can we draw from these index figures? At first glance it seems that the pattern of communication centres and peripheries identified for the year 1870 has changed only marginally over the thirty years of observation. From a static, punctual perspective this impression generally holds true. The big European nations of Great Britain, France and Germany together with a number of compact countries such as Belgium, the Netherlands and Switzerland (who all held considerable stakes in international business) form the core of the European communications network. Denmark, Austria and Italy can almost always be found in midfield, while most other European countries (most notably Spain) lag far behind. The non-European countries seem completely underdeveloped in telegraphic terms. Indeed, this pattern has changed but little during the last thirty years of the nineteenth century. Therefore, the centres and peripheries of telegraphic communication have been solidly identified. On the basis of these first findings, suitable case studies can now be selected. And for several countries such as Switzerland or Belgium arguments of business and trade interests probably do not go far enough to explain their extraordinary development in telegraphy. More detailed research at the national and regional level will be necessary to fully explain the lead these two countries have been enjoying in several categories for a number of decades.

While the identification of communication centres and peripheries serves a very practical purpose and prepares the ground for comparative

studies of these regions, the statistical data processed here holds more useful information. In Table 5, the data presented in the previous tables has been reorganised to allow for an examination of potential trends in telegraphic development. Such trends can indeed be observed and are very telling, even if they were not yet pronounced enough to alter the general pattern discussed in the previous paragraph. It is, for instance, clearly visible that the extremely well-developed smaller countries gradually lost out against the bigger players over the course of the thirty years. Belgium, the Netherlands and Switzerland start out with very high values, but soon enter into a downward spiral in practically all categories. From this we can deduce that these countries had reached a certain limit in telegraphic development rather early, while the greater nations were still far from being fully developed. The latter entered into a telegraphic race in the closing decades of the nineteenth century that resembles their colonial race in extra-European theatres. Unified Germany developed very quickly and thoroughly, while Great Britain managed to further expand its network of lines and wires but also saw a pronounced relative decline in density of telegraphic bureaus (in comparison to the other competitors). Interestingly, midfielders such as Austria, Italy or Denmark have witnessed very little upward or downward development. The same holds true for the European countries of the lower third. Here, very little change is observable.

Many of the few non-European entities featured in these early ITU statistics show a very promising development toward the end of the century. Although most of them cannot compare with the level of development achieved by Great Britain or Germany, interesting trends can be observed. Japan, for instance, takes a huge leap between 1890 and 1900. This development is even more impressive if we keep in mind that the figures in our tables have been indexed related to a selected European average which has increased over the years as well. The same holds true for the vast landmass of densely populated India, which starts to develop quite promisingly after 1880. And even Russia, whose figures are likewise distorted by its extraordinary size, shows a slight upward trend throughout our period of observation. The white settler colonies in Natal, New Zealand and Victoria also qualify for closer examination. It seems quite clear that their high values in internal messages per head are indeed a consequence of low population density. However, the relatively few people living there must have used the telegraph rather intensely. Would this indicate a different approach to and use of new technological means in settler/frontier societies? Little can be said about this on basis of the data presented here – especially as the classic frontier society in the west of the United States (represented here only by the Western Union telegraph company) eludes analysis due to a lack of data.

Concluding, it seems that this brief survey study has raised more questions about the centrality or remoteness of certain world regions in the

**Table 5. Indexed data on network structure and use of electric telegraphy in selected countries, 1870–1900 (selected European average = 100).**

| | Lines/Area | | | | Wires/Area | | | | Bureaus/Area | | | | Bureaus/Pop. | | | | Int.Mess/Pop. | | | | Ext.Mess./Pop. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1870 | 1880 | 1890 | 1900 | 1870 | 1880 | 1890 | 1900 | 1870 | 1880 | 1890 | 1900 | 1870 | 1880 | 1890 | 1900 | 1870 | 1880 | 1890 | 1900 | 1870 | 1880 | 1890 | 1900 |
| Austria | 96 | 144 | 88 | 95 | 114 | 133 | 86 | 90 | 84 | 103 | 100 | 96 | 84 | 96 | 91 | 84 | 61 | 68 | 57 | 85 | 91 | 72 | 85 | 87 |
| Belgium | 257 | 235 | 221 | 186 | 310 | 386 | 369 | 296 | 348 | 319 | 255 | 203 | 139 | 116 | 89 | 66 | 191 | 167 | 145 | 140 | 173 | 201 | 206 | 175 |
| Denmark | 87 | 111 | 113 | 87 | 84 | 103 | 109 | 91 | 88 | 87 | 78 | 68 | 127 | 118 | 99 | 81 | 84 | 107 | 87 | 77 | 210 | 261 | 206 | 218 |
| France | 138 | 161 | 177 | 225 | 142 | 165 | 197 | 251 | 138 | 126 | 147 | 129 | 128 | 123 | 146 | 136 | 91 | 196 | 259 | 301 | 52 | 74 | 83 | 72 |
| Germany | 115 | 162 | 185 | 203 | 137 | 206 | 222 | 222 | 153 | 226 | 258 | 240 | 138 | 184 | 203 | 174 | 99 | 114 | 123 | 163 | 125 | 79 | 78 | 77 |
| Great Britain | n.a. | 166 | 156 | 201 | 231 | 269 | 337 | 449 | 314 | 210 | 193 | 193 | 203 | 131 | 116 | 112 | n.a. | 343 | 536 | 566 | n.a. | 91 | 96 | 93 |
| Greece | 62 | 88 | 114 | n.a. | 26 | 40 | 48 | n.a. | 17 | 21 | 22 | n.a. | 38 | 44 | 46 | n.a. | 50 | 80 | 120 | n.a. | 14 | 49 | 59 | n.a. |
| Hungary | 59 | 56 | 57 | 61 | 65 | 70 | 51 | 90 | 40 | 38 | 46 | 53 | 51 | 54 | 61 | 75 | 59 | 47 | 44 | 67 | 12 | 65 | 52 | 57 |
| India | 10 | 10 | 16 | 20 | 6 | 9 | 18 | 20 | 1 | 4 | 7 | 7 | 1 | 5 | 7 | 7 | 2 | 3 | 4 | 5 | 0 | 1 | 1 | 1 |
| Italy | 104 | 110 | 117 | 125 | 113 | 126 | 120 | 117 | 86 | 95 | 108 | 109 | 66 | 69 | 78 | 74 | 51 | 84 | 81 | 80 | 38 | 32 | 25 | 26 |
| Japan | n.a. | 22 | 33 | 62 | n.a. | 17 | 33 | 75 | n.a. | 6 | 7 | 23 | n.a. | 5 | 5 | 15 | n.a. | 23 | 33 | 89 | n.a. | 1 | 1 | 4 |
| Netherlands | 159 | 143 | 153 | 160 | 199 | 182 | 188 | 176 | 165 | 146 | 182 | 160 | 96 | 81 | 95 | 78 | 207 | 215 | 159 | 153 | 255 | 230 | 217 | 177 |
| Norway | 34 | 34 | 23 | 32 | 19 | 22 | 15 | 33 | 10 | 10 | 9 | 14 | 118 | 111 | 102 | 154 | 108 | 120 | 154 | 179 | 131 | 136 | 124 | 137 |
| Portugal | 56 | 60 | 74 | 78 | 39 | 52 | 56 | 51 | 30 | 26 | 35 | 25 | 46 | 38 | 53 | 35 | 31 | 45 | 58 | 49 | 22 | 47 | 74 | 75 |
| Romania | 48 | 40 | 33 | 37 | 23 | 22 | 25 | 29 | 12 | 15 | 19 | 20 | 20 | 33 | 43 | 45 | 59 | 62 | 63 | 81 | 41 | 40 | 36 | 38 |
| Russia | 4 | 5 | 5 | 6 | 3 | 4 | 4 | 6 | 1 | 1 | 1 | 1 | 14 | 24 | 21 | 9 | 18 | 29 | 27 | 34 | 8 | 10 | 7 | 7 |
| Serbia | n.a. | 55 | 59 | n.a. | n.a. | 28 | 35 | n.a. | n.a. | 15 | 20 | n.a. | n.a. | 30 | 32 | n.a. | n.a. | 41 | 76 | n.a. | n.a. | 27 | 27 | n.a. |
| Spain | 40 | 40 | 48 | 55 | 34 | 35 | 38 | 38 | 9 | 9 | 18 | 16 | 18 | 18 | 37 | 33 | 32 | 43 | 60 | 59 | 16 | 23 | 29 | 23 |
| Sweden | 26 | 32 | 19 | 18 | 24 | 29 | 18 | 16 | 15 | 22 | 18 | 25 | 104 | 143 | 122 | 165 | 69 | 69 | 67 | 81 | 69 | 79 | 79 | 86 |
| Switzerland | 218 | 195 | 168 | 143 | 172 | 168 | 150 | 133 | 304 | 325 | 266 | 269 | 327 | 325 | 273 | 255 | 309 | 282 | 223 | 135 | 252 | 287 | 280 | 254 |
| Western Union | n.a. | 28 | n.a. | 34 | n.a. | 29 | n.a. | 50 | n.a. | 17 | n.a. | 16 | n.a. | 177 | n.a. | 120 | n.a. | 294 | n.a. | 231 | n.a. | n.a. | n.a. | 8 |

*Source*: See Tables 1–4.
*Note*: See Tables 1–4 for particulars on the calculation of the index.


*History Compass* 5/5 (2007): 1720–1742, 10.1111/j.1478-0542.2007.00461.x

global telegraph network of the nineteenth century than it has eventually answered. Beyond suggesting research questions which might inform later studies, its modest contribution lies in identifying communication centres and peripheries. It thus provides basic information needed for more detailed comparative studies which will try to find the particular reasons behind the patterns and developments that have been observed here.

*Acknowledgement*

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*Short Biography*

Roland Wenzlhuemer is a trained historian and lecturer and researcher at the Centre for British Studies at Humboldt-Universitaet in Berlin, Germany. His research interest lies mainly within colonial history, telecommunications history and especially wherever there are touching points between the two. He is currently in the midst of a research project called 'Continuity and Change in the History of the Information Society: From the Telegraph Network to the Internet' and seeks to establish how – from the late eighteenth century onwards – global telecommunications networks impacted on local societies. Roland Wenzlhuemer is an Honorary Research Fellow of Birkbeck College, London. He studied History and Communication Science at Salzburg University, Austria. Specialising in British imperial history he earned a Master's degree and a Doctoral degree both at Salzburg University in 1999 and 2002 respectively. His doctoral thesis dealt with the socio-economic transformation of the British Crown Colony Ceylon in the late nineteenth century. He joined the Centre for Modern Oriental Studies in Berlin in 2003 and has been with the Centre for British Studies since April 2005.

*Notes*

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[1] D. Bell, *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York, NY: Basic Books, 1973).

[2] M. Castells, *The Rise of the Network Society* (Malden, MA: Blackwell, 1996); Castells, *The Power of Identity* (Malden, MA: Blackwell, 1997); Castells, *End of Millennium* (Malden, MA: Blackwell, 1998); Castells (ed.), *The Network Society: A Cross-Cultural Perspective* (Cheltenham: Edward Elgar, 2004).

 

[3] See, for instance, M. Kranzberg, 'The Information Age: Evolution or Revolution?', *Information Technologies and Social Transformation* (Washington, DC: National Academy of Engineering, 1985), 35–54; C. Freeman and F. Louçã, *As Time Goes By: From the Industrial Revolution to the Information Revolution* (Oxford: Oxford University Press, 2001).

[4] The term *telegraphy* is not very concrete in itself. As *optical telegraphy* it encompasses optical information transmission, for instance via the semaphore, as well. Such information technology has been around since the late eighteenth century. As *electric telegraphy* the term only refers to communication by the use of an electric current as the information carrier. This technology was researched by a number of different people in the 1830s and 1840s and was brought to technical maturity by Messrs. Cooke and Wheatstone in the UK and Mr Morse in the US both around the year 1844.

[5] I would like to thank David Christian for pointing out that this was the time when information transmission became *materialised* – in contrast to the *dematerialisation* of telecommunication in the nineteenth century that forms our focal point here.

[6] See, for instance, V. Aschoff, *Nachrichtentechnische Entwicklungen in der ersten Hälfte des 19. Jahrhunderts* (Berlin: Springer, 1987); Aschoff, *Beiträge zur Geschichte der Nachrichtentechnik von ihren Anfängen bis zum Ende des 18. Jahrhunderts* (Berlin: Springer, 1989).

[7] *Physical* here is a tricky concept as in the strict sense of the word there is indeed physical movement. Electrons move and carry a coded message. However, the movement of electrons obeys rules different to those of the movement of more complex entities such as human bodies, horses, carrier pigeons, railways, etc.

[8] Manuel Castells introduced his idea of the *Space of Flows* in his book on *The Informational City* in 1989 and has since refined the concept in most of his following publications; M. Castells, *The Informational City: Information Technology, Economic Restructuring, and the Urban Regional Process* (Oxford: Blackwell, 1989).

[9] See B. Holten, 'Telegraphy and Business Methods in the Late 19th Century', paper given at Cross-Connexions Conference, Science Museum, London, November 2005.

[10] See, for instance, R. Heilbroner, 'Do Machines Make History?', in M. R. Smith and L. Marx (eds.), *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: The MIT Press, 1996), 56–7.

[11] Heilbroner, 'Do Machines Make History?', 56.

[12] J. Mokyr, 'Technological Inertia in Economic History', *The Journal of Economic History*, 52/2 (1992): 325–38.

[13] It is important to note that *resistance* does not only refer to active moves against a particular technology in the style of, for instance, the Luddites. It also encompasses passive resistance, i.e. a reluctance or outright refusal to adopt and promote a technology.

[14] D. Edgerton, 'From Innovation to Use: Ten Eclectic Theses on the Historiography of Technology', *History and Technology*, 16 (1999): 1–26.

[15] D. Edgerton, *The Shock of the Old: Technology and Global History since 1900* (Oxford: Oxford University Press, 2007).

[16] Edgerton, 'From Innovation to Use', 112.

[17] J. Kieve, *The Electric Telegraph: A Social and Economic History* (Newton Abbot: David & Charles, 1973).

[18] A. Lubrano, *The Telegraph: How Technology Innovation Caused Social Change* (New York, NY: Garland, 1997).

[19] A. Blok and G. Downey (eds.), *Uncovering Labour in Information Revolutions, 1750–2000* (Cambridge: Cambridge University Press, 2003); G. Downey, *Telegraph Messenger Boys: Labor, Technology, and Geography, 1850–1950* (New York, NY: Routledge, 2002).

[20] Holten, 'Telegraphy and Business Methods'; M. Kallioinen 'Information, Communication Technology, and Business in the Nineteenth Century: The Case of a Finnish Merchant House', *Scandinavian Economic History Review*, 52/1 (2004): 19–33; Y. Kaukiainen, 'Shrinking the World: Improvements in the Speed of Information Transmission, *c.*1820–1870', *European Review of Economic History*, 5 (2001): 1–28; B. Lew and B. Cater, 'The Telegraph, Co-Ordination of Tramp Shipping, and Growth in World Trade, 1870–1910', *European Review of Economic History*, 10 (2006): 147–73.

[21] Conférence Télégraphique Internationale de Vienne 1868. Révision de la Convention de Paris, 34, 86–90.

[22] Since 1934, ITU stands for International Telecommunication Union. In 1947, it was made a specialised agency of the United Nations. A year later it moved from Berne to Geneva where the ITU still resides today and remains the world's oldest international organisation. Y. Utsumi, 'World Telecommunication Day, 17 May 2006. Promoting Global Cybersecurity', *Message of ITU Secretary-General*, 17 May 2006, http://www.itu.int/newsroom/wtd/2006/sg_message.html, accessed on 13 March 2007.

[23] I would like to use this opportunity to thank the staff of the ITU library and especially Heather Heywood for their invaluable support.

[24] For the purpose of this study, all non-European countries featured in the ITU statistics have been eliminated as their generally very uneven telegraphic development would have distorted the averages. The same is true for Russia whose European part was rather well developed, but whose averages were completely distorted due to its overwhelming landmass. Similarly, Great Britain has not been included in the calculation of the average as its extraordinarily thorough development in this early period of telegraphy would have distorted the index as well. The number of countries included in the calculation of the index varies each year, because data for every country was not always available. The exact list of countries included can be found beneath Tables 1–4.

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