

The Critique of Industrial Technology in the Netherlands and other Western Countries in the Nineteenth Century

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1. Introduction

As a first introduction to the cultural response of Dutch society to the coming of industrial technology, let me tell you a little anecdote. One night in 1842, a certain Frederik van Sorge – a grocer, radical journalist and municipal secretary in a small town in the Netherlands – lay awake worrying about the misery that machines and factories could bring about. While thinking about this, he had a vision. Five beings from outer space, having pity on mankind for the drudgery by which it had to make a living, descended upon the earth and installed a great many machines and robots, that took over all human labour. Within a short time this apparatus created a tremendous amount of very cheap products. But the aliens had forgotten one thing. Since the working people had lost their jobs, they had also lost their income. Therefore, they could not buy even the cheapest machine-made goods. Wealth concentrated in the hands of a small elite, while the rest of the people sank into poverty and had to rely on poor relief. Fortunately, the good beings recognized their mistake. They came back and destroyed all the machinery they had introduced. The people went back to work and once again earned their living.¹

This little story suggests that both machinery and violence against its introduction were considered “alien” phenomena in the Netherlands, reflecting the fact that most machinery came from elsewhere – though not from outer space – and that violence occurred more in dreams than in reality. This does not mean that fundamental criticism of modern technology, including violence against machines, did not exist in the Netherlands, but that it was a rather isolated phenomenon.² In this paper I will discuss three critics of modern technology in the Netherlands and try to explain why their criticism remained so isolated. In doing this, it will be illuminating to compare their thinking and their position with that

of critics elsewhere in Europe. I will therefore begin by giving a brief overview of the critique of modern, especially industrial, technology in western Europe.

2. Ideological reactions to industrial technology

The response to industrial technology has always been extremely divergent in both form and content. Both positive and negative reactions could be found in all strata of society. In this paper I will focus upon the critique, not the praise. Also, I am not interested in the whole gamut of critical ideas as such, but in *ideology*, that is, in the relationship between ideas and power, or in other words: the way ideas about technology structure the experience and actions of influential persons and groups. It is no accident that the emergence of the ideological movements which have shaped the politics of industrial societies – liberalism, conservatism, christian democracy, socialism and their various derivatives – appeared shortly after the beginning of industrialization: they were interpretations of the sea-change that was taking place and they presented alternative marching routes into the industrial future.

Studies about the relationship between technology and ideology in the nineteenth century are too scarce to base a well-balanced overview on.³ From what we now know, it appears that a fundamental shift occurred around the middle of the nineteenth century. Before that time, criticism of and resistance to modern technology was much more widespread than in the second half of the century. Before 1850 the reference point for critics was the pre-revolutionary society of the eighteenth century; thereafter the inevitable disappearance of the old order was more or less accepted and critics became more future-oriented. Let us now look at the first half of the nineteenth century. Criticism at this time came from mainly three groups: working people who were threatened by unemployment as a consequence of mechanization, conservative magistrates and politicians, and romantic writers.

The most impressive study of resistance to modern technology during the early industrialization that I know is Adrian Randall's *Before the Luddites*.⁴ Randall describes how the introduction, from the 1770s on, of spinning jennies and scribbling engines met with fierce resistance from workers in some areas in the woollen goods producing districts of England. Often, troops were called in to protect the houses and machinery of the innovating clothiers against furious attacks of the crowd. These disorders led to a full-scale discussion about the social desirability of the new machinery. The workers hired lawyers to argue their case in the courts. They appealed to old statute law which prohibited innovations that

would cause unemployment and that protected the apprenticeship system. They found support among some of the landowning elite, some of whom wrote pamphlets on their behalf. The innovating entrepreneurs then submitted the question to Parliament which, after much lobbying from both sides, repealed the old statutes in 1809. In this way, room was made for free industrial enterprise and innovation.

The case against machinery included several arguments. In the first place it was argued that people thrown out of work by machines would have to be supported by the community. This argument was shared by many landowners, who paid the highest poor rates. One of them wrote in a pamphlet: "A trade is valuable to a country in proportion to the number of hands it employs."⁵ Since the new machinery would only line the pockets of a few clothiers while ruining the rest of the community, it should be forbidden. As to the apprenticeship system, the innovators rightly saw this as an impediment to the introduction of factories. But to the workers and the traditionalists it was an essential institution for preserving the social order, because it regulated the socialization of the young.

Against these arguments, the innovators pointed to the cotton industry, where the enormous output of cheap cloth had easily found an expanding international market. Therefore thousands of people had found work in textile factories and cheap clothes had become available to the working classes. To this optimistic picture of expanding markets was added the warning that if Britain failed to innovate, other countries would do so and would flood the market with their cheap goods. In their opinion, the welfare of the country left no alternative to the introduction of machines.

This pattern of arguments was repeated again and again in the first half of the nineteenth century. In England, conservative politicians such as Oastler and Sadler, representing the old landed aristocracy, took up the case of the handloom weavers and factory workers in the 1830s and 40s.⁶ They too laid much emphasis on the destruction of the family by the factory system which would have disastrous effects upon the social and moral order. They pleaded for a tax on machinery and played a leading role in the Ten Hours Movement, which achieved a shortening of working hours in the 1840s.

These conservatives took some of their arguments from romantic writers such as Robert Southey, Thomas Carlyle and Mary Shelley, who explored the wider ramifications of the "machine age". Carlyle, for example, pointed to what he called the "mechanization" of all aspects of life in industrial society: the Lancaster system of basic education, modern Government, which put a premium upon efficiency instead of moral argument, and a materialistic, mechanical way of thinking, which was displacing the concern with what he called "Dynamics", "the primary, unmodified forces and energies of man, the mysterious springs of Love,

and Fear, and Wonder, of Enthusiasm, Poetry, Religion, all of which have a truly vital and *infinite* character". "Men have grown mechanical in head and heart, as well as in hand", he wrote.⁷ In *Frankenstein* (1818), Mary Shelley described minutely and hauntingly how the drive for intellectual and technical domination destroy love and life itself.

In other countries, for example in Switzerland and in the German states, violence against machinery also occurred, accompanied by similar debates. Here too, workers were supported by part of the elite. The German states are especially interesting, because already in the eighteenth century some of them actively supported innovating entrepreneurs, e.g. by granting them exemptions from guild restrictions. This policy was opposed by the landed aristocracy. Their most important theorist at the beginning of the nineteenth century was the romantic economist Adam Müller, who was a declared foe of modern technology. On the other hand, many government officials saw no alternative to industrialization if the country was to compete with Britain. But they also discussed ways of avoiding the social turmoil that industry had caused there. One of them was Franz von Baader (1765-1841), a mine official and glass manufacturer in Bavaria, who had observed the social impact of industry during a trip in England and Scotland between 1791 and 1796.⁸

Von Baader was a conservative thinker, in that he pleaded for a reinstatement of the old social order, with the clergy, aristocracy and bourgeois firmly in their own places. But unlike Adam Müller, he was in favour of technological development, which he thought was a necessary part of social development in general. Since every technological innovation brought with it social stresses, it should not, according to Baader, be left to private enterprise, but should be regulated by the state. He called for the establishment of a government agency for assessing the possible effects of innovations. Not only economic, but also social costs of an innovation, such as unemployment, should be considered when deciding whether or not to introduce an innovation. Possible victims should be indemnified. The state should also carry out large technological projects, such as roads and mining, which are useful for the whole nation. It should employ tariffs to protect native industry. In general it should prevent that some economic interests would operate at the expense of others and ensure that the benefits of technological improvement would be evenly distributed.⁹

I remind you, that neither conservatives, nor romantic writers, nor craftsmen and workers were all opposed to technology (or to all machinery). The response was mixed in every group. In England, for example, most Tories remained aloof from the battle against industrialism. Outside England Romantic writers hardly paid any attention to technology and industry, which is not surprising, because in the heyday of Romanticism industrialization on a great scale only took place in

England. Some romantic writers wrote admiringly of industry and machinery. The German theologian Schleiermacher, for example, predicted that machinery would release men from drudgery so that they would be able to devote themselves to more spiritual pursuits.¹⁰ Others were fascinated by the “sublime” spectacle of mines, foundries, and steam locomotives: the mixture of dread and admiration that the power, the fire and the smoke of machines evoked, became a fashionable theme.¹¹

But what the examples I have given do show, I hope, is the importance of ideology. The introduction of machines has been resented and feared in many times and places. But these feelings could only develop into a political force of some consequence, to the extent that they were articulated in a kind of theory, that showed the wider social meaning of technological innovation and made this criticism relevant to wider strata of society than those immediately concerned. The strength of the English weavers’ resistance derived from the coincidence of their interests with those of part of the aristocracy, but also from the fact that they were protecting a meaningful social order against destructive forces. And the example of Von Baader suggests how a critical attitude of Government officials could have led to something like what we now call technology assessment in the early industrial period.

During the second half of the nineteenth century industrialization and the waning of the old order were gradually accepted as inevitable. This reorientation can be explained by changes in the relationship between the new and the old elites, changes in attitudes among the industrial working class and the emergence of the modern labour movement. Both in Germany and in England rivalries between the landed aristocracy and the rising industrial bourgeoisie abated; there was a considerable mingling and cooperation between the two. In the industrial areas the number of workers who had never known anything but industrial labour grew. For them, the old social order was no longer the standard by which to measure social relations. Modern labour unions therefore accepted the industrial order and tried successfully to improve the position of the workers within that order, for example by claiming higher wages and shortening of the working day. Technology and the quality of work practically ceased to be a theme of discussion. Karl Marx, whose ideas were very influential in the social-democratic movement after 1880, argued that capitalism was a transitional phase, in which the means of production were perfected, creating tremendous wealth. Like the liberals, marxists considered the problems of industrialization as temporary symptoms of the transition to a better world. They directed their efforts towards the future, instead of lamenting the loss of old values. In this climate, critics of technology such as William Morris and Heinrich Riehl were considered marginal figures.

3. Three Dutch critics¹²

The first of the three Dutch critics whom I want to introduce to you is Frederik van Sorge (1803-1851), the radical journalist whom we already met at the beginning of this paper. In 1842 he published a pamphlet "about the influence of machinery upon the wealth of nations".¹³ It was a contribution to a lively discussion about the problem of poverty, which was going on in several European countries. Although there were only very few really large factories in the Netherlands at the time, Van Sorge was worried about their introduction, for which academic economists were pleading. He warned that labour saving machinery would create mass unemployment, as it had done in England. This in turn would lead to the collapse of the market, even for cheap goods, which would happen even sooner when other countries would follow the lead of England and mechanize production. Widespread poverty would be the result.

Van Sorge was not against machinery in general. Mechanizing the process of production would enable the people to pursue higher, intellectual goals. Whether they would be able to earn a living in this way depended upon the market for books and periodicals, in other words on the level of civilization. Van Sorge therefore pleaded for the extension of education, which would create more opportunities for writers, journalists and other intellectual workers. Only when this change in the labour market would cause a shortage of manual labour has the time come for the introduction of labour saving machinery, he argued. Until that time the introduction of machinery should be impeded by means of a tax on machines. The returns of this tax should be used to carry out large public works, such as land reclamation projects and railroads, which would also create work for the unemployed. For each kind of work a minimum wage should be determined, based upon the needs of the worker. As long as international agreement upon these matters was lacking, Dutch industry should receive protection by means of tariffs.

Van Sorge's vision reminds us of Von Baader. Like the German official, he was not against machinery as such, but he rejected the idea that technological innovation should be left to private enterprise. The economy and technology should serve human needs and therefore had to be regulated. Van Sorge had only scorn for the argument that cheap products create a market for themselves, thereby enlarging employment: "But why, I ask, more consumption than necessary in order to live pleasantly? Is this not an abuse of the gifts of nature?"¹⁴

A critical attitude toward industrial technology was also prevalent in some government circles. In the early 1830s, for example, the government sponsored Dutch Trading Company set up a textile industry in the eastern part of the country (this was after the Belgian secession, when the Netherlands lost, in one stroke,

their most important industrial area).¹⁵ The secretary of the Trading Company, Willem de Clercq, and the English engineer who was to supervise the project, Thomas Ainsworth, agreed that they would not introduce power machinery, but the most advanced hand technology. Ainsworth wrote: "The neat cottage with its little garden and rosy-faced children in my opinion is a far more pleasurable sight, than to stand at a cotton mill door at 9 o'clock on a winter's night and contemplate the squalid looks of a few hundred poor wretches, who, whilst living, are dying."¹⁶ The secretary of the Trading Company said that the Company aimed at a widespread cottage industry, which allowed workers to combine farm work with industrial labour. It must be added, that the cheapness of labour was another important argument for preferring hand technology.¹⁷

On the other hand, most Dutch academic economists were enthusiastic about modern industrial technology and urged Dutch entrepreneurs to follow the British example. All the well-known arguments of the political economists were echoed in the leading Dutch economic journals.¹⁸ After 1870, a new generation of liberal intellectuals started to write prolific books about the social problems which accompanied industrialization. They argued that those problems should not be blamed upon machinery, but upon "human ignorance and immorality, obsolete institutions and laws".¹⁹ Social legislation could, in their opinion, ensure that technology would serve the needs of all.

We need not go into the ideas of Dutch Socialists. Their opinions echoed those of Socialists in other countries. Whether radical or moderate, they all believed technical progress would benefit the workers, once they had assumed control of the state. Therefore, resisting technological progress was considered reactionary and workers were urged to direct their protests at improving their position within industrial society.

More typical of the Dutch situation is the reaction of the churches.²⁰ I will discuss two representatives of the most pronounced religious-political movements in the Netherlands, the Neo-Calvinists and the Roman Catholics.

The best example of a romantic critique of modern technology in the Netherlands came from the leader of the Orthodox Protestants (or Neo-Calvinists), Abraham Kuyper (1837-1920). Kuyper had been trained for the clergy at the university of Leiden, but he had turned away from the modernist theology which was being taught there and had experienced a conversion to radical Calvinism. He became the leader of the opposition of the Orthodox Protestants against the rule of liberalism in the state and the church. His campaign for government subsidies for denominational schools led to the first modern political party in the Netherlands (1879). When he could not convert the Dutch Protestant Church, he led the Orthodox Protestants in a secession (1886). He started his own newspaper

and his own university, the still existing Free University of Amsterdam. I will first discuss a speech Kuyper held in 1869, in which he argued for the right of the orthodox protestants to their own place in society. This plea was embedded in a full-scale attack upon modern society, including modern technology, which often reminds us of Carlyle.²¹

The speech was titled "Uniformity, the curse of modern life". Modern society tends toward uniformity, Kuyper contended. Compare, for example, the endless variety of facades in the old towns of Holland, the charming irregularity of the streets and canals to the dead monotony of modern cities, with their straight streets and housing blocks. The modern state, another example, is ruled by centralized bureaucracies and a politician is no longer his own man, but has to conform to the party machine. Considering technology in a more material sense, the same tendency is visible: "A steam engine eliminates the rich variety which gave every trade something charming. The power of capital, concentrating in an alarming way, sucks away the life blood of our small enterprises."²² Modern means of transportation and communication work in the same direction: they wipe out differences between peoples. This will result in "one big metropolis, which will know neither north nor south, east nor west; all life will be the same because it will show the uniform traits of death."²³

During the 1870s and 1880s Kuyper slowly relinquished his extreme anti-modernist position and especially his attitude towards modern technology. When for example he traveled through the United States in 1898, he reported enthusiastically to his newspaper about the skyscrapers, the electric streetcars, the comfort and speed of the trains and the telephone and typewriter in his hotel room.²⁴ When in 1896 the ore workers in the Rotterdam harbour struck against the introduction of electrical cranes, he called their action useless and unwise, because those cranes were part of a general process of mechanization which would eventually also benefit the workers.²⁵ In his theoretical writings after 1890, Kuyper claimed that it was a divine command that christians contribute to technical progress.²⁶ Like the Socialists and the Liberals of his time, Kuyper asserted that the problems often associated with technology should not be attributed to technology itself but to its uses, and therefore to the institutions and norms of society.

Neither Kuyper himself, nor students of his life and thought have explained this fundamental change in outlook. The most probable explanation is that Kuyper had changed his strategy. When he spoke about "Uniformity" in 1869, he was at the beginning of his career, taking the lead of the "small people", as they were called, the Orthodox Protestant craftsmen, labourers and small farmers, in their fight against the rule of liberalism. But Kuyper wanted much more than the vindication of the rights of this religious minority. He wanted to re-christianize

the whole society. He realized that this could never be done by mobilizing the petty bourgeoisie against capitalism and socialism and by resisting modern technology and industry. Rather, he should use modern means for his own ends and try to win over capitalists and workers. He therefore incorporated some of the ideas of liberalism and socialism in his ideology; and among these was the wholesale acceptance of modern technology. This attitude has been well characterized by the theologian Haitjema: "The Neo-Calvinist wants to feel at home in the modern world; even more than that: he wants to master it."²⁷

My third witness is A.H.J. Engels (1867-1940), a devout Roman Catholic weaver in Twente, in the eastern part of the Netherlands, where, as I just described, textile industry had been introduced during the 1830s. Engels was one of the founders of the first Roman Catholic trade union in 1889. In 1907 he published a very personal account of the advent of the factory system in Twente and in the same year he analysed the actions of the Rotterdam grain workers against the introduction of unloading machinery.²⁸ These publications show Engels' pessimism regarding the effects of modern industrial technology upon the workers.

The sketch "Fabrieksmenschen" (factory people) shows clearly that Ainsworth's and De Clercq's dreams about an idyllic textile producing population did not materialize. Life of the textile workers was characterized by poverty and exploitation. The introduction of the factory system after 1850 (when government interference in the economy was gradually abandoned) made things worse: the spinners and weavers, who had always supplemented their incomes with some farming, now became completely dependent on the factories and their harsh owners. Violent resistance against machinery, as described by Randall, did not occur here. This may be explained by the fact that employment in the textile industry rose much sharper than the population (thanks to the protected market of the Dutch colonies in the East Indies and a growing domestic market) and that, at least after 1866 for which period data are available, real wages also rose.²⁹ Nevertheless, there was an increasing number of strikes, sometimes accompanied by violence against the property of industrialists. These actions were often directed against the lowering of piece rates when more efficient machinery was introduced.³⁰

Engels became convinced that technical development could not be stopped and that resistance against it made no sense. Later, when discussing the thousands of injuries and mutilations of working men, women and children reported by factory inspectors, he concluded that slowly but inexorably the army of invalids was growing, "victims of the industrial war of competition" in which only money counts. In his comments upon the dockworkers' strike against the introduction of unloading machinery in 1907, Engels suggested that municipal government should take charge of this, in order to make a more gradual transition possible.

But he did not sound very convinced that such a proposal would have any chance of acceptance. Other Catholic union leaders showed a similar pessimism.³¹

Engels was no original thinker, but his place in the Roman Catholic social movement is interesting. The ideas about technology of Roman Catholic leaders had evolved in a way very similar to Kuyper's. Before 1890, not many of them paid much attention to the problems of industry, but those who did were extremely critical. Following the lead of pope Pius IX, they rejected everything liberal and modern, such as the new secondary schools which had a lot of natural science in their curricula, and modern industry. But when Leo XIII became pope in 1878, the Roman church changed its strategy towards the modern world.³² In his encyclicals *Aeterni patris* (1879) and *Rerum novarum* (1891) the pope proclaimed a more positive attitude towards science and technology and urged the clergy to help the workers create Roman Catholic labour unions that could stand up for both their material and their spiritual rights. From the 1890s on we see in Roman Catholic periodicals a very positive attitude toward modern science and technology. Technological innovation was presented, as it was by Kuyper, as a divine command. The direct links between technology and the misery of the workers, as documented by people like Engels, were denied: these problems could only be blamed upon the liberal-capitalist order of society, which misused the products of human intelligence, which were really a gift of God. Once society would be ordered along corporative lines, technology would benefit everyone.

Engels' writings show clearly that he was unable to reconcile this sanguine view with what he saw. But it is significant that neither he nor other union men ever openly challenged the official position of the church. Writing about the protests of the Rotterdam dock-workers against the introduction of unloading machinery in 1907, Engels said that technological innovation cannot be stopped, even though it costs thousands of workers their jobs; "and", he added, "for the sake of progress it should not be stopped". This apparent contradiction (if something cannot be done, the question whether it should be done becomes irrelevant) shows his unease with the official point of view.

4. Conclusion

At the end of the nineteenth century there was a remarkable convergence in attitudes and ideas about industrial technology among the main ideological currents in the Netherlands. Technological and social development were regarded as two separate phenomena: technology was the expanding arsenal of means by which man would improve his wealth and his mastery over the world. This would be to

everyone's benefit, if only legislation would be improved to protect the workers, as the Liberals said, or if the workers would come to power, as the Socialists claimed, or if society was reconstructed along the lines of corporatism, as the Orthodox Protestants and Roman Catholics argued. The attitude of the Liberals and Socialists did not change significantly during the period studied, but the churches experienced a kind of conversion to technological optimism. I have tried to explain this as a strategic move, intended to strengthen their position in a secularising world, in which the onmarch of modern technology and modern labour relations seemed inevitable. This tendency may also be observed in other European countries, but unlike Germany and England for example, the Netherlands hardly had an undercurrent of criticism of modern technology. Why was this so?

I think part of the answer is to be found in the weakness of the Romantic and Conservative movements in the Netherlands as compared to surrounding countries. These movements were to a large extent a reaction to the Enlightenment, the industrial revolution and the French revolution. The Netherlands partook all these changes, but in a very moderate way, which explains at least partly why Conservatism and Romanticism did not strike deep roots in Dutch society. Since these movements produced the most radical and consistent critique of modern industry, their weakness in the Netherlands goes a long way to explain, why incidental protests against modern machinery did not find a sounding board in the discussions of the elites, who were, on the whole, convinced of the prosperity industry would bring the nation. In practice this meant that the shoemakers in Brabant who destroyed machines during the crisis of the 1880s and the dock-workers in Rotterdam who fought various innovations between 1880 and 1907 did not find the support of those who could have defended them in the courts or taken up their case in parliament, as happened in Britain and Germany. This is one of the reasons why the industrial revolution in the Netherlands, in spite of the great changes it wrought in society, did not provoke any sustained resistance.

Notes

1. F. van Sorge, *Over de invloed van machines op de welvaart der volken* (Middelburg 1842), 9-14
2. I. J. Brugmans, *De arbeidende klasse in Nederland in de negentiende eeuw* (Utrecht 1978) 183; J. van Meeuwen, *Zo rood als de roodste socialisten* (Amsterdam 1981) 60.
3. The best studies have been done for England and the United States. See for England M. Berg, *The machinery question and the making of political economy* (Cambridge 1980); M. Berg, *The age of manufactures 1700-1820* (London 1985); A. Randall, *Before the Luddites* (Cambridge 1991); about the United States J. F. Kasson, *Civilizing the machine* (Harmondsworth 1977); L. Marx, *The machine in the garden* (London 1967). Germany: R.P. Sieferle, *Fortschrittsfeinde? Opposition gegen Technik und Industrie von der Romantik bis zur Gegenwart* (München 1984); Th. Hollenbach, *Lob und kritik der industriellen Revolution in England und Deutschland 1800-1848* (Frankfurt am Main 1990); W. König, "Die Rezeption von Technik und Industrie in der katholischen Romantik", in T. Pirker e.a. (Hg.), *Technik und industrielle Revolution* (Opladen 1987).
4. Randall, op. cit.
5. Randall, op. cit., 240
6. See for the following Berg, *Machinery question*, chapter II.
7. Th. Carlyle, "Signs of the time" (1829) in *Selected writings* (Harmondsworth 1980) 67, 72.
8. König, op. cit.
9. Similar ideas, stressing the role of the state in regulating the economy, may be found in Fichtes *Der geschlossene Handelsstaat* (1800). See R. Kurz, *Der Kollaps der Modernisierung* (Frankfurt am Main 1991), 35-38.
10. König, op. cit. 247; Sieferle, op. cit. 51.
11. Kasson, op. cit. 166-168; F. D. Klingender, *Art and the industrial revolution* (1947) (Frogmore 1975), chapter 5; for the Netherlands see D. van Lente, J. W. Schot, "Heyenbrock en de Nederlandse industrialisatie" in W. Buitelaar e.a. (red.), *In het spoor van Heyenbrock* (n.p.n.d. 1988) 20-29.
12. See for more a extensive discussion of the Dutch response to modern technology my *Techniek en ideologie* (Groningen 1988) and "Ideology and technology. Reactions to modern technology in the Netherlands 1850-1920", in *European History Quarterly* 22/3 (July 1992), 383-414.
13. F. van Sorge, op. cit.
14. F. van Sorge, op. cit., 21
15. For the following, see R. T. Griffiths, *Industrial retardation in the Netherlands 1830-1850* (Den Haag 1979), 138-149; E. J. Fischer, *Fabriqueurs en fabrikanten* (Utrecht 1983), 61-90.
16. Griffiths, op. cit., 146.
17. Griffiths, *ibid.*
18. See for example the review of Van Sorge's pamphlet in the well-known journal *Tijdschrift voor staathuishoudkunde en statistiek* (1844) II, 129-140.
19. H. Goeman Bourgesius, "Stoommachines en volkswelvaart" in *Vragen des Tijds* (1876) I, 25.
20. It is hard to say exactly how typical, since hardly any research has been done about this subject in other countries.
21. If we understand technology as every kind of goal-directed organization, whether of matter or of human relations, the whole speech is really about technology. In this Kuyper resembles two other thinkers who have been strongly influenced by calvinism: Carlyle, who in "Signs of the times" spoke of the "mechanical age" and Jacques Ellul, who criticized "la technique".
22. *idem*, 19.
23. *idem* 21.

24. A. Kuiper, *Varia Americana* (Amsterdam 1899) 33-38.
25. *De Standaard* 25 March 1896.
26. See especially A. Kuiper, *De gemeene gratie* (Leiden 1902-1904) and A. Kuiper, *Pro rege* (Kampen 1911-1912)
27. Cited in S. J. Riderbos, *De theologische cultuurbeschouwing van Abraham Kuiper* (Kampen 1947) 270-271.
28. A.H.J. Engels, *Fabrieksmenschen* (Leiden 1907); A.H.J. Engels, "De staking in de Rotterdamse haven" *Katholiek sociaal weekblad* 26 oct. 1907, 492; "Gemeentelijke exploitatie van elevators" *Katholiek sociaal weekblad* 2 July 1910, 319.
29. Fischer, op.cit., 82, 164
30. H.D. Grobber, "Sociale conflicten en sociale organisaties in de Twentse textielindustrie 1860-1912" *Textielhistorische bijdragen* 12 (1971) 41-42.
31. E.g. H. Hermans, *Handboekje voor de RK werklidenverenigingen* (Amsterdam 1919 2nd ed.) 26, 27.
32. See B. McSweeney, *Roman catholicism. The research for relevance* (Oxford 1980) chapter 3.

Transatlantic Technology Transfer: The Reception and early Use of the Telephone in USA and Europe

Helge Kragh

Invention of telephony

The idea of transforming speech into electrical pulses so as to make it amenable to wire transmission goes back to the 1850s, when several people thought of how such a scheme could be realized. Charles Bourseul in France, among others, devised in 1854 a method for transmitting pitches of sound telegraphically, but it was only in the early 1860s that the first primitive apparatus of this type – a telephone – was constructed. It was done by Johan Phillipp Reis, a German school-teacher, who invented an apparatus where the sound controlled the electrical current from a battery. Reis succeeded in transmitting single tones and, imperfectly, sounds over a narrow range of frequency; but the quality was so poor that there was no market for his invention, which was not further developed. In spite of Reis and other precursors, the merit of having invented a practical telephone belongs unquestionably to Alexander Graham Bell, the Scottish-American inventor and teacher of the deaf, who in 1874 envisaged an electromagnetic telephone where a membrane, actuated by the voice, produces electrical oscillations by vibrating in front of a magnet. In Bell's original scheme the transmitter and receiver were identical, and the electricity was supplied by the current induced by the permanent magnet in the telephone itself, which thus did not need an external battery.

Two years later Bell and his assistant, Thomas A. Watson, had developed his idea into an apparatus that enabled them to transmit complete sentences, the first one being the famous “Mr. Watson – come here, I want you.” Bell received U.S. patent no. 174,465 for his invention of the telephone on March 7, 1876, an event which heralded a new age in the history of telecommunication. Several other inventors, including Thomas Edison, Elisha Gray and Amos E. Dolbear in America, Poul la Cour in Denmark and David Hughes in England, worked with ideas of electric telephones at the same time. Bell only filed his application for a