

Introduction: Networking Technology, Networking Society, Networking Nature

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‘The Netherlands develop into a network society and a network economy. Citizens’ and companies’ activities play out in ever larger spaces.’ This observation does not stem from a sociologist analysing present day societies, but from the Fifth National Policy Document on Spatial Planning (2001) by the government of the Netherlands. The concept of the Network Society has gained wide currency in academia as well as in policy making. For the Dutch cabinet the term ‘networks’ not merely denotes information and communication technologies, as for many network society theorists, but ‘the entirety of roads, railways, waterways, pipelines and sewers, digital networks, seaports, airports and transfer points.’ They constitute an intermediary layer in society in between the natural condition and the social structure and shape ‘where people live, work, and spend their leisure time.’¹

This special issue of *History and Technology* analyses the historical shaping of the Netherlands as a ‘Networked Nation.’ To understand the dynamics, functioning and vulnerabilities of today’s network societies is an urgent task, and the Netherlands provide an intriguing example. Here the mutual shaping of society and network technologies has a particularly long history. During the Middle Ages, drainage systems made much of the territory inhabitable in the first place. In Early Modernity, rivers, ports and canals shaped the military and economic viability of the Dutch Republic.

However, only in the 19th and 20th centuries the Netherlands became a truly Networked Nation. In these centuries, the Dutch built material networks—for energy supply, transport, communication, even ‘nature’—that were national in scope and ranked amongst the densest in the world. These networks increasingly tied together the entire country, even its most remote buildings, fields, and (man-made) forests, into a single, artificial (that is, human-made) space. The new geography of networks or ‘large technical systems’ enabled the Netherlands’ nearly complete cultivation, its exceptional population density, its productive agriculture, and its large-scale industries.² Untrodden nature disappeared as wet and dry nature were manipulated and domesticated: by 1970,

merely 6% of the territory still counted as ‘natural’, but in 2000 also these zones were in the process of being redesigned and integrated in the sphere of human constructs. An extreme progress of the human-built environment, tied up with the proliferation of multiple networks, created a network society without equal.

Network Societies and the History of Technology

Asking the broad question of how Dutch society and network technologies historically co-evolved, this volume addresses two literatures. That modern societies develop in interaction with network technologies is a core assertion in the literature on network societies. The ‘network society’ concept is best known from Manuel Castells, who relates the rise of the current network-shaped global society to the rise of information and communication technologies in the last few decades.³ Others have shown that societal change intertwined with a broad array of network technologies over a much longer time span. Eighteenth and nineteenth century philosophers and politicians argued that modern societies could be forged through waterway, road, railroad and telegraph line construction; by the early 1830s Saint Simonian and future French Senator Michel Chevalier had coined this idea in the concept of the ‘circulating civilization.’⁴

However, while raising many important issues, this literature fails to develop the point of intertwining societal and infrastructural changes beyond the trivial. Even Castells trilogy on the network society in the Information Age only includes a brief section on the genesis of ICT, disclaimers denouncing technological determinism, and a few theoretical observations on technology and society. The rich descriptions of social changes in production, work, finance and crime, for example, emphasize network (relational, informational and global) features, but how these changes relate to technological developments remains implicit. Incidentally, the same is true for the literature of nation building, which may pinpoint transport and communication systems as conditions *sine qua non* for 19th and 20th century nation-state building, but tends to leave the mechanisms involved unexplored.⁵

The history of technology, on the other hand, has developed ample sensitivity for the role of agency in technical change, its socio-cultural embeddedness and unpredictability, and mechanisms of mutual construction of technologies and societies. However, fears of being labelled ‘technological determinist’ have long prevented historians of technology from asking such broad questions as the one that is at stake in this volume.⁶ This is true even for the literature on ‘Large Technical Systems’ (LTS), the history and sociology of technology specialization on network technologies. This field, to which this special issue is much indebted and to which it wants to contribute, is rather heterogeneous in terms of methodology, and there is no consensus on a formal definition of LTS.⁷ Still, one way or another LTS scholars address material networks, the term we shall use for geographically expanded, society-wide material structures. LTS scholarship helped place such networks prominently on the history of technology research agenda as 20th century technological frontiers with major societal implications, acting as ‘deep structures’ shaping where modern people live, work, play and wage war.⁸

Canonical LTS publications claim exactly the interaction between technology and society as their domain of study.⁹ However, even here we do not find a satisfactory understanding of the co-evolution of network technologies and societies. To be sure, we learn a lot about the history, dynamics, change potential, and governance of network technologies themselves. We also learn about some types of societal changes—changes that are part and parcel of socio-technical system building processes (again, we shall speak of ‘network building’) that are often the object of study. Still, changes outside the realm of network building processes in, for example, other social domains (how indeed do people live, work, play, and wage war?) and nature usually stay out of sight.

The picture is changing though. A growing number of scholars today again regard technology’s wider societal implications as a legitimate research subject. They understand that this issue can be approached in non-determinist ways and is too important to leave to journalists. The history of technology has started to address societal history at large. To reinterpret 20th century history through the lens of technology was also the ambition of the Dutch national history of technology programme, which defines the context of this publication. The programme ran from 1995 to 2003, involved some 70 researchers, had a budget of some 10 million euros and was co-ordinated by a foundation, the Foundation for the History of Technology. It produced books, articles, PhD theses and a seven-volume series (containing 15 books) in Dutch with Johan Schot, Harry Lintsen, Arie Rip and Adri Albert de la Bruhèze as chief editors.¹⁰

The development of large technical systems, or networks, was one of several crosscutting themes in this programme. This special issue presents the programme’s synthesis on the co-construction of networks and Dutch society, coined in the term Networked Nation, to an English speaking audience.

Networking Technology, Society and Nature

How can we analyse the shaping of the Networked Nation? The terms ‘network’ and ‘nation’ have many meanings. The word ‘network’, originating in lace making, may nowadays refer to technical, social or socio-technical structures keeping different components together and consisting of lines and nodes. It is much older than the late 19th century term ‘infrastructure,’ which became popular only after the Second World War.¹¹ We use ‘network’ to denote society-wide material structures constituting the hardware of network societies. Furthermore, we use the term ‘nation’ in its broad meaning of a country or society within the territorial borders of the Dutch state, as in—and opposed to—the word *international*. This means that we explicitly focus upon Dutch society rather than upon transnational network societies, which will be addressed in other projects.¹² Also, we do *not* use the term ‘nation’ in the narrow meaning attributed to it in nationalism scholarship investigating how communities and collective identities are constituted in mental processes or every day practices.¹³ The concept Networked Nation refers to the shaping of Dutch society in processes of material network building.

Taking a broad view, this special issue brings into vogue the material networking of Dutch society in three rarely juxtaposed realms: technology, social institutions and nature.¹⁴ We invited authors to analyse network building in these different realms.

Most familiar to historians of technology, infrastructural or network *technologies* such as railroads, electricity supply systems and telecommunication networks were increasingly expanded and integrated on a (trans)national scale from the mid-19th century onwards. The sociologist Renate Mayntz even argued, in terms of sociological systems theory, that infrastructural systems evolved to a full-blown societal subsystem on a par with education, health, production or the military: they developed such features of institutional differentiation as: a separate knowledge base, norms, values and profession structure; large managing organizations; high internal integration; society-wide reach; and high social inclusion.¹⁵

The first article by Verbong and Van der Vleuten maps the development of multiple infrastructures in the Netherlands and reveals a veritable material unification by the 1960s. The article addresses the contested dynamics of this process for selected networks (electricity supply) and nodes (Amsterdam Schiphol Airport, the Rotterdam harbour and the city) and new societal vulnerabilities that accompanied it.

Material network building, however, extended beyond the realm of network technologies. Mayntz observed how during the 20th century network technologies increasingly and asymmetrically structured other social subsystems. Castells puts it even better: in the Information Age, social domains (production, the financial sector, crime) developed network features in interaction with network technologies. This reproduction of a network morphology throughout society may be one of the most interesting implications of the proliferation of network technologies.¹⁶

To unravel this reproduction process we draw on Ingo Braun's studies of organ transplantation and waste recycling. These sectors, Braun argued, were set up in processes akin to socio-technical system or network building. The *Eurotransplant* organization, for instance, mobilized and juxtaposed a variety of transport and communication infrastructures (termed 'first order large technical systems') into one heterogeneous, materially integrated, spatially extended superstructure (termed 'second order large technical system') organising flows of people, information and organs.¹⁷ Braun developed this approach to investigate future internal LTS developments in forms of mutual intermeshing (*Vernetzung der Netze*), but it can also be used to investigate how different societal domains acquired network properties.

The next three articles in this special issue analyse how this took place in the societal domains of banking, food, and industrial production. Hermans and De Wit explore how the financial sector used communication technologies to build financial networks for the case of the Dutch securities trade. Albert de la Bruhèze and Van Otterloo show how a multitude of actors in the food business mobilized network technologies to build material food networks currently called 'food chains.' They investigate the milk chain or 'Milky Way' in detail. Davids, finally, shows how infrastructural changes helped create networked industrial production companies for the case of the Dutch multinational

Philips. In these cases, actors transformed societal domains mobilizing and juxtaposing network technologies to create (second order) material networks circulating flows of foodstuffs, value, raw materials, products and labour throughout Dutch society and beyond.

The proliferation of human-built material networks is visible in still a third realm, nature. Castells observed how the network society constitutes a new era in the sociological tradition, which interprets social action from the perspective of changing relationships between Nature and Culture. Schematically put, while Culture was dominated by Nature social organization reflected the struggle for survival. The Enlightenment submission of Nature to Culture was accompanied by a social organization aiming at exploiting natural resources. In present-day network societies, however, Nature is maintained only as a cultural form and, Castells maintains, social organization revolves around flows of information rather than the natural environment.¹⁸

Again, we take this observation one step further. The last two articles in this special issue show that in the Netherlands humans not only appropriated and reshaped Nature, but did so in the form of material network building.¹⁹ Van der Vleuten and Disco examine the co-construction of wet nature and society, the capstone of which was the national water supply network completed around 1970. Finally, Van den Belt shows how ecological network building recently became an important nature management technique, of which the Dutch were pioneers in Europe.

Understanding the Networked Nation

What, then, did we learn about simultaneous network and society building from the Dutch case? First, taking a view on the Dutch networked nation broader than (LTS) historians of technology usually do, this special issue brings into vogue how technical, social and natural landscapes were transformed into human-built network morphologies. These related events, usually studied separately in technological, geographical, social, business and ecological history, jointly produced the artificial geography of the networked nation.

Second, studying these events from an actor perspective more than network society theorists usually do, we make visible agency, contingency, and choice in the shaping of the Dutch networked nation. There was no universal logic or theory behind network development independent of actors and their concerns, as macro-sociological and geographical network society studies sometimes seem to imply. The development of electricity supply networks, harbours and airports, food networks, financial networks, industrial networks, and wet and dry ecological networks was shaped by different constellations of actors, different actor perceptions and concerns, the outcomes of negotiations and conflicts, and different contexts.

Third and perhaps most important, this special issue explores ways to causally relate technical change to a large variety of wider societal changes while simultaneously appreciating moments of contingency, agency and choice.²⁰ The case of Dutch eating habits may illustrate this point. Dutch food historians observe a remarkable event around

1960: a local or regional variety in meal and food patterns had given way to a ‘unification of the Dutch meal.’ Dutchmen of different social classes throughout the country ate roughly the same food at the same time: two bread meals and an evening meal consisting of soup, a main course of potatoes, salad and meat or fish, followed by a dessert.²¹

On one hand, one can causally link (meaning establishing a chain of events, not a *necessary* chain of events) this event back to the transport revolution.²² One can describe how predominantly regionally integrated transport networks were succeeded by nationally integrated ones from the mid-19th century; how actors in the food business mobilized these transport networks to set up food chains (second order networks) that, by 1960, were predominantly organized on a national scale; how these food chains produced a rich, standardized and cheap assortment available to every social group in every corner of the country; and how these groups selected, prepared and consumed foodstuffs in a surprisingly homogeneous way.

On the other hand, we show that this chain of events was by no means a necessity, as proponents of the so-called ‘homogenization thesis’ might suggest—taking the homogenizing effect of network technologies on e.g. language and food habits for granted. It involved much work done by many groups, multiple choices and also conflict. I would identify at least three moments where things could have gone different. First, the design of nationally integrated transport networks followed the contested dynamics of sociotechnical network building processes. Second, the same applies to institutional network builders in the food sector, who could mobilize the infrastructural basis in several ways to shape food chains; in this case, concerns of competition (translated into up scaling strategies) in a context of changing market conditions and government policies promoting scale increase ultimately produced food chains on a predominantly national scale by 1960.

Finally, consumers could have chosen differently from the astoundingly rich assortment of food that was offered to them. Yet government agencies, advertising companies and home economics teachers—amongst other groups—had worked for decades to influence eating habits for improving national health and boosting the position of Dutch food industries on their home market. Jointly they produced a rather unidirectional field of force in which consumers uniformly selected, prepared and consumed food by 1960. Notably, in the next decades food chains expanded to predominantly transnational levels, but Dutch food and meal patterns fragmented due to, among others, new working conditions and mass tourism.

We have come one step closer to connecting the development of network technologies to changes in where and how people live, work, eat, etc. Much work remains to be done, however, to uncover historical events and mechanisms that continue to shape present day network societies.

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Notes

- [1] Cabinet, *Ruimte maken*. Quotations from the English summary or my translation. The latest spatial policy document maintains the focus on networks despite a change on the degree and form of government interference. Cabinet, *Nota Ruimte*.
- [2] Gras, *Les macro-systèmes techniques* speaks of the new 'geography' or 'space-time' of LTS.
- [3] Castells, *The Information Age*. Most read is Vol 1: *The Rise of the Network Society*.
- [4] Mattelart, *Networking the World*. Mattelart, *The Invention of Communication*. Mattelart, *Mapping World Communication*.
- [5] Weber, *Peasants into Frenchmen*. Weber's work inspired Knippenberg and de Pater, *De eenwording van Nederland*, which inspired this volume.
- [6] Compare Misa, 'Retrieving Sociotechnical Change', 138.
- [7] Van der Vleuten, 'Infrastructures' and Joerges, 'High Variability Discourse.'
- [8] For this argument, see Hughes, *Networks of Power*. Hughes, *American Genesis*. Hughes, 'Historical overview'. Hughes, *Rescuing Prometheus*.
- [9] In the canonical literature, I include: the work of Tom Hughes; the anthologies Mayntz and Hughes, *The Development of Large Technical Systems*; La Porte, *Social Responses to Large Technical Systems*; Summerton, *Changing Large Technical Systems*; and Coutard, *Governing Large Technical Systems*. In other language areas: Braun and Joerges, *Technik ohne Grenzen*; Gras, *Grandeur et dépendance* and *Les macro-systèmes techniques*; Kaijser, *I fädrens spår*; Blomkvist and Kaijser, *Den konstruerade världen*. Some lesser-known contributions to this literature do ask broader questions of societal change and provide important points of departure for the studies in this volume.
- [10] Schot, *Techniek in Nederland*. See also www.histech.nl
- [11] Van Laak, 'Der Begriff "Infrastruktur".'
- [12] Kaijser and Van der Vleuten, 'Networking Europe Research Agenda.' Van der Vleuten and Kaijser, 'Networking Europe Review Essay.' See also www.histech.nl/tensions.
- [13] Smith, *Nationalism*. Schot, 'Imagining and Living Europe.'
- [14] Van der Vleuten, 'In Search of the Networked Nation.'
- [15] Mayntz, 'Zur Entwicklung.'
- [16] Castells' claim is disputed in Van Dijk, *The Network Society*.
- [17] Braun, 'Geflügelte Saurier.' Braun and Joerges, 'How to Recombine.'
- [18] Castells, *The Information Age*, Vol 1, 477.
- [19] Kaijser, 'Technological Systems in the Natural World.'
- [20] Van der Vleuten, 'Infrastructures and Societal Change.'
- [21] Jobse-van Putten, *Eenvoudig maar voedzaam*, 499-506. Van Otterloo, 'Voeding.'
- [22] Fischer, *America Calling*, criticizes determinism as well as lack of causal specificity in technology and society studies.

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