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INTRODUCTION

Imagined use as a category of analysis: new approaches to the history of technology

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On the outskirts of Moscow, the Russian company KrioRus is freezing people – dead people, to be precise, together with a number of equally dead animals. KrioRus is Russia's first cryonics company. Its founders believe that if cooled to $-196\text{ }^{\circ}\text{C}$ at the exact moment of clinical death, people can later be resuscitated. Later is defined as 'a time when science had advanced sufficiently to cure [those people] of old age or illness' that had caused their death. One founder of KrioRus, Danila Medvedev, drew inspiration mainly from science fiction and especially books by Arthur C. Clarke and Robert Heinlein. Science fiction informed a scientific business. More than that, KrioRus relies fundamentally on imagined uses of cryonic technology. Since the 1960s, this *imagined use* of technology, or rather the imagined future purpose of cryonics, has led Russians and Americans to spend millions of dollars on freezing dead bodies today. After two American companies, KrioRus is the world's third largest cryonics company with up to 140 frozen 'patients'.¹ Members of the cryonics' 'weird world', as the *Financial Times* called it, are united by their vision of how the technology of freezing people might prolong life.

Alongside ideas about different purposes or users for a technology, technologies also offered a way to imagine and structure the future. Imagining how technology could be used was often distinct from actual use. This special issue explores the multiple dimensions of *imagined uses* of technology. Here, we use telegraphy as our case study. Telegraphy, we argue, is particularly apt for exploring the interpretive territory of imagined use. On the one hand, its price structure generated a relatively small number of users. On the other hand, news sent by telegraph reached a much greater number of people and opened up a space for imagined uses of telegraphy amongst the many who read news sent by telegraph but never entered a telegraph office. In its role as news medium the technology opened up the very information space necessary for these visions of use in the first place. Our four articles demonstrate that alongside actual use, imagined uses of a technology fundamentally become an integral part of processes of technological development, innovation and design.

Historians of technology have made great strides in understanding the multi-faceted processes of innovation and use. The 'great man' history of inventors is a methodological relic replaced by analyses that include multiple social groups in innovation processes, the influence of technology-in-use on innovation and investigations of the social construction

of technology (SCOT).² Some have historicized how our modern concept of technology emerged in the contexts of wide-ranging innovations and changing public discourse.³ Others have pushed for scholars to think critically about the objects and aims of our histories of technology, including the fetishization of innovation.⁴ Scholars, finally, agree that innovation and use are inextricably intertwined. They have demonstrated the great interpretive flexibility of technical artifacts and their uses because people may use the same kind of artifacts for very different applications.⁵ Overall, the concept of ‘use’ seems to be key to understanding processes of technological change.

Simultaneously, some scholars have critiqued the SCOT approach as too narrow. While social constructivism at first sight moves away from deterministic sequences of technological progress and the great man thesis, it still focuses on powerful actors. Langdon Winner has criticized the approach for ‘finding contingency rather than necessity’ as well as neglecting the ‘deep-seated political’ and, we would add, cultural and socio-economic biases that can underlie ‘the spectrum of choices that surface for social actors.’⁶ Social constructivism only examines those actors directly relating to or interacting with the technology-in-use. It does not explore non-users affected by a technology, marginal groups putting the technology to non-mass marketed use or those *imaginatively* using it. Depending on the technology, concentrating just on a narrow conception of users could exclude vast groups of people. In the case of global telegraphy, for instance, roughly 90% of the world’s population never sent a telegram.⁷ If scholars of telegraphy only focused on actual users or consumers, they would neglect most of the world’s population – and their status as users in a different, broader sense. Here we focus on how imagined use created certain social and political conditions rather than how use as consumption created individual and class identities.⁸

Our special issue proposes a reassessment of ‘use’ as an analytical category for the history of technology in general and social studies of technological change in particular. While previous scholars have focused on actual, physical uses of technology, we argue that imagined uses, as part of or beyond such contexts, were just as important. Beliefs about technologies and their potential capabilities for a technological future alongside dreams, fears and visions of technological utopias as well as dystopias influenced innovation and use just as much, if not sometimes more, than contemporary appropriations of a particular technology. Sometimes actors imagined uses even though they had never physically interacted with the technology itself. Novelists such as Charles Dickens, Mark Twain, or Henry James quite openly fantasized about technological uses. In ‘On an Amateur Beat’, for instance, Charles Dickens imagined new forms of machinery to eliminate the threat of white lead poisoning among factory workers. Inspired by his telephone and typewriter, Mark Twain developed a growing interest in the Society for Psychical Research’s experiments on telepathy. Henry James became similarly fascinated with ‘ghost writing’ and the potentials of latest communication technologies. Literary scholar Adrian Poole asserts that James would have loved the mobile phone.⁹ These imagined uses shaped cultural narratives about technology as harbingers of modernity, as agents of universal peace or, in the case of distorted man-machine relationships, as the end of mankind. Imagined uses structured the political framing of technological research or use and influenced the physical development of technologies. Imagined uses, as this special issue shows, could be just as important as actual uses of technology.

Imagined uses are particularly pertinent for the modern world where modern technological devices of communication, media and news allowed large groups of people to learn

and subsequently speculate about new technological innovations before or even without ever using them. Our focus on imagined uses of technology suggests three important new perspectives to social studies of technological change in the modern era. First, the concept of imagined uses broadens the social groups involved in processes of innovation and appropriation to include those who may never have interacted physically with the technology itself. Imagined use complicates the distinction between users and non-users. The category may help research to move beyond Eurocentric, gendered and elite narratives to include the marginal and the subaltern.¹⁰ Second, the introduction of imagined uses emphasizes the radically different time horizons that could affect technological innovation. The history of imagined uses is also a history of imagined futures; irrespective of whether the technological future we imagine becomes reality or not.¹¹ Contemporaries foresaw how a technology might revolutionise their society a year, a generation or a century hence, whereby technologies might even be employed to create a particular national vision of the future.¹² These ideas affected how they or others planned and innovated while trying to create the future they wanted or, for some sceptics, the future they dreaded.¹³ Technology-in-use is about the now; imagined uses relied upon visions of the future that fundamentally shaped the present. Third, the concept enables scholars to better integrate the analytical category of 'use' with intellectual and cultural history. Intellectual and cultural historians frequently investigate mentalities or discourses. Historians of technology have also called recently for more examinations of technologies as cultural practices or productions.¹⁴ We seek to integrate those techniques with the fruitful perspectives from historians of technology, who have emphasized the mutual interaction between technology and use. By combining imagination and use, our special issue explores how discourses and mentalities could affect technological innovation and physical use. Imagined uses threw up many understandings of technology that could vary widely and even contradict each other. By taking imagined use seriously, we can examine competing visions beyond elites and users. Imagined use also provides another approach to pushing past normative assumptions about technological change or innovation.

Our special issue examines the question of *imagined uses* through the example of telegraphy. Telegraphy is a particularly pertinent example, because such a small percentage of the world's population actually ever sent telegrams. Around 90 companies sent the vast majority of telegrams across the Atlantic, which was the busiest stretch of submarine cables.¹⁵ Only in the early twentieth century did telegrams become cheap enough to emerge as a mass medium of communication in the United States.¹⁶ At the same time, the advent of telegraphy fundamentally changed the course of the world in the mid-nineteenth century. The technology's speed and apparent instantaneity in addition to the worldwide reach of telegraph networks provided the basis for processes of global integration and interdependence. Jorma Ahvenainen has argued that the global submarine cable network facilitated the very existence of 'world commerce' and 'world politics'.¹⁷ Telegraphy transformed the very business of making and distributing news for journalists, editors and news businesses like news agencies.¹⁸ These developments created spaces of information that were accessible to people otherwise excluded from the communicative space of telegraphy. By using the concept of imagined use to explore the history of telegraphy, our contributions include visions and perspectives from those 99% disconnected from actual global telegraphy and illustrate their contributions to the persistently dominant narrative of telegraphy as a 'revolutionary' technology.¹⁹

Historiographical intervention

Recent and not-so-recent approaches in the history of science and technology, such as technology-in-use, *Large Technical Systems* (LTS), SCOT or the material approach have urged scholars to move away from a great man thesis of the glorious inventor or from viewing technological change as linear.²⁰ Already in the 1990s, there was a shift from science to technology, or from the modern to the postmodern as Paul Forman put it.²¹ Sociologists of scientific knowledge became engaged in a social study of technology. Critiquing Whiggish and progressive narratives of ‘revolutionary’ technologies altering world history, these scholars sought to explore cultural and social appropriations of technologies as well as the social and cultural construction of technology.²² They also urged a semantic shift from the term ‘invention’ to ‘innovation’ to emphasize the continual evolution of various technologies.²³

Within the study of innovation, design history has, like SCOT, long pointed to the impact of users’ applications and feedback on technological development. Technology does not determine human action, but human action determines technology. Scholars follow Clive Dilnot’s imperative to put socio-historical understanding at the center of attempts to understand design activity. Technology is not formed in isolation from society, but technology and society are ‘formed and transformed simultaneously and in correlation.’²⁴ These socio-technical networks that transmit knowledge of technological design can have national, transnational or transcontinental scopes.²⁵ Technology in the end is a co-creation between designer and user embedded in larger socio-economic and cultural systems.²⁶

Both SCOT and design history’s examinations of ‘use’ tend to focus on how the social relationships surrounding technology can empower the users of that technology. These scholars privilege micro-historical studies of use and appropriation over macro-historical studies of structures of innovation. Their studies valuably refocus our attention on use over invention, small over big, user and consumer over inventor. At the same time, however, these approaches downplay the early decision-making processes in research and development, the disagreements over design and the schemes of technological use that did not make it onto the desks of decision makers. These approaches can neglect structural frameworks such as broader economic or political contexts behind technological development that determine, for instance, the relevant actors driving technological change. By foregrounding successful applications of technology only, these approaches carry the shadows of technological determinism, sequential technological change and Eurocentric perspectives.²⁷

We argue that expanding the concept of use to include imaginary use offers new perspectives on the innovation paradigm. It expands our group of relevant social actors to include the marginal and the subaltern, while linking structural formations with the actors’ level. The category of imaginary use shifts emphasis from the ‘heroic inventor’ and the ‘relevant social groups’ to include a wide array of actors of different social, national and professional backgrounds, who related *imaginatively* to the technology. Without necessarily ever physically using the technology, these actors still shaped the financial, political or marketing regimes that provided the structural conditions of technological development.

Imaginary use as an analytical category not only expands the actors involved in innovation, but also expands the timeframe. On the one hand, it re-incorporates the process of invention in the laboratory, allowing for studies minutely sketching out discussions or rivalries even over possible technical designs. On the other hand, it sheds light on visions of a technological future, which actors were hoping as well as dreading would become reality.

Current literature on technological futures wants to inspire readers with equal measures of awe and dread of what is technologically possible, just as it wants to warn us that humanity's present course leads towards (environmental) disaster.²⁸ Sociologists such as Niklas Luhmann and Anthony Giddens alongside historian Reinhard Koselleck have portrayed an orientation towards the future as typical for modern societies. While traditional societies tended to look at the past to interpret current events and developments, modern societies believe in the capability to 'determine' their 'own future rather than leaving it to religion, tradition, or the vagaries of nature'.²⁹ Technological advances were key for this shift, according to Luhmann.³⁰ Telegraphy even inserted an entirely new type of business, *futures* trading, into the modern global economy.³¹ Technology helped make use of the future.

Finally, imagined use offers another way of rethinking technological determinism, path dependencies and 'constitutive choices' in media and technological development. Such choices, we argue, derived not just from actions and decisions, but also imagined uses.³²

This special issue focuses on telegraphy to tease out the nuances of imagined use. Aside from its importance for world politics, economy and news, telegraphy also influenced cultural and social appropriations of gender and spirituality alongside discourses of knowledge and communication. Like other communications technologies such as radio or television, private and public actors initially appropriated the telegraphs in myriad ways before its application as technology-in-use became increasingly standardized and restricted.³³ Moving beyond the approach of technology-in-use, we combine actual and imagined usages of new technologies to explore the multiple technological modernities that contemporaries envisaged.³⁴ These usages found expression in the innovations' technological, political and economic realities as well as their social and cultural constructions. Imagined uses shaped the history of telegraphy in the fields of finance, science and politics, as well as social and cultural narratives. They did so, finally, by transgressing borders defined by race, class, gender or nation.

Imagined uses of technologies were, first of all, a marketing tool. Innovators in search of supporters were trying to sell not just the technology, but also future technological possibilities. Even before regulated and institutionalized research laboratories, inventors and entrepreneurs recruited others to fund and collaborate on their dreams of a particular technological future. Imagined use of a potential future rather than actual use determined the course of many technologies in their early stages. Even the 'nestor' of the independent inventors, Thomas A. Edison, initially thrived through the financial, technological and moral support of the American engineer Franklin Leonard Pope. Pope's imagined use of technology much more concerned the electrical whiz kid from Boston himself than any particular technology. He let Edison work and sleep in his office and connected him with his personal network. Although their partnership over the telegraph ticker was dissolved soon after it had been established in 1869, their collaboration actually precipitated the invention of the stock ticker.³⁵ Innovation was a social process. 'Great inventors' were not necessarily 'independent' inventors.³⁶ As Catherine Davies' contribution explores, this ticker became essential for economic prognoses used for stock exchanges. It helped establish notions of trust through fast and slow conveyance of information as users imagined that each means of communication would lead to particular interpretations of the facts by recipients. Telegraphy, postal services, wireless transmission as well as later on radio, television, and film each elicited particular 'visions' of anticipated emotional outcomes from recipients or viewers. Content-producers used these technologies to try to trigger particular emotions

or reactions, though they were better at selling their content or technological visions to investors than measuring efficacy.

Second, imagined uses of telegraphy shaped scientific practices. Indeed, competing imagined uses determined the inclusion and exclusion of particular social groups.³⁷ Through these battles over imagined usages of telegraphy, dominant groups hierarchized technological knowledge into the scientific and the vernacular, while simultaneously standardizing and institutionalizing that knowledge. The nineteenth century in particular was the time when science became institutionalized and ‘inventions’ were increasingly enclosed within big research laboratories. Simultaneously, access to science and technology regulated conceptualizations of not only potential users, but also potential scientists. Simone M. Müller shows in her book on the *Wiring of the World* how visions of technological literacy and eligibility shaped access to technological research and development. In the case of telegraphy, these imagined uses helped establish the modern presupposition of the superiority of theory over practice and with it of science over technology.³⁸ Similarly, Heather Ellis illustrates how access to scientific communities was bound to a particular image of ‘the inventor’. Guglielmo Marconi, her story’s protagonist, only managed to gain access to these communities by successfully transforming this image of the inventor altogether. Richard Noakes’ contribution suggests that imagining occult uses of telegraphy could even further scientific research. As these works illustrate, the concept of imagined use reveals a sense of value and validity of particular types of knowledge; the concept underscores how technologies come to privilege certain types of knowledge, certain methods of creating technical knowledge, and certain actors within the global world of science and technology.

Third, imagined uses built upon and often reinforced social orders and hierarchies. Heather Ellis’ contribution illustrates that modes of exclusion that came with visions of technological use had a distinct gender connotation. Though they could be emancipatory, imagined uses of technology could mirror processes of exclusion and inclusion along the lines of race, class and gender.³⁹ Finally, even the epistemology of science and technology was Eurocentric. In early modern China for instance, processes of planning functioned to produce knowledge and technological change.⁴⁰ Albeit visionary, imagined uses often stayed within the limits of what was conceivable according to contemporary social and cultural norms.

Fourth, there were significant political and regulatory consequences for imagined uses of technology. Scholars in the Tensions of Europe network have examined how physical cross-border infrastructures created concrete manifestations and visions of Europe.⁴¹ Our special issue explores this process in the opposite direction. Visions of technological use in particular times and places affected that technology’s development and implementation. The example of ‘dirty industries’ like hazardous waste management illustrates how multi-national enterprises often develop their technologies along the lines of national political visions laid down in the guise of thresholds for pollution or rules and regulations.⁴² In the realm of communications, the NSA’s beliefs about the use of Internet technology have led NSA officials to cooperate with companies to install backdoors to their software. The NSA’s visions of potentially nefarious uses of technology concretely affected their political intervention with firms. In other words, political involvement in technological development can also be influenced by how a group imagines that others will use and are using a technology. As Heidi Tworek’s article explores, German fears about British uses of cable and wireless technology led the German government to intervene in companies’ research and development of wireless technology.

Finally, imaginary visions of the future held great cultural significance, often drawing on moral narratives of the ultimate good or evil of particular technological developments. Science fiction, for instance H.G. Wells' trilogy *The Time Machine* (1895), *The Island of Doctor Moreau* (1896) and *War of the Worlds* (1897), overcomes the agnosticism, i.e. the lack of any moral implications, inherent to studies focused on analysing technology. Wells' dystopian vision of technologically ignited disasters resonates in many cultural narratives of Armageddon caused by technology.⁴³ Fiction often portrays humanity as threatened by the very technologies that we create. In *The Matrix* (1999) machines make us slaves of our own social system. *I Robot* (2004) warns us from creating artificial life that is too intelligent. Such destructive visions of a technological future seem to create a cultural and moral border that science may not cross in its research and development. Nowadays, this seems to be most pertinent in the study of genetic mutations and cloning. Worldwide public outcry over the cloning of a sheep in Scotland in 1994 suggests that not everything that is technologically possible should actually be done. A wave of protest over Dolly the sheep arose from people's concerns about the 'slippery slope'. Their fears about future developments in cloning led to warnings against continuing such research altogether.⁴⁴

Scholars have benefitted immensely from considering the interaction between use and innovation. Our special issue takes these interactions in a different direction by focusing on how imagined and discursive appropriations of telegraphy affected innovation and use. How and why did telegraphy become a speedy and secretive means of exact communication based upon scientific standards that fed the idea of an inherently masculine technological modernity? Why was telegraphy ruled out as a mass communicational tool? Who influenced and hindered distinct developments? What roles did governments, business or international organizations play in these appropriation processes? Our contributions do not solely analyse how telegraphy came to be used, but why. They unveil the intricate relationship between technological process, social development and conceptions of 'modernity'.

Historiography of telegraphy

Telegraphy consisted of two separate, but linked systems. The dense network of land-line telegraphy was generally owned and operated by governments, except in the United States. This first system was physically connected to, but organizationally distinct from the globe-spanning submarine cable network controlled by an oligopoly of multinational cable companies. The separation of the two emerged in many ways because governments could not conceive that enough of their citizens would wish to send telegrams overseas, giving states little incentive to control submarine cable networks. Simultaneously, private entrepreneurs like Cyrus W. Field drew on an ambitious vision to lay a transatlantic cable. They imagined that only businesses, the press and governments would send messages below the sea. Field and others structured their cable businesses accordingly to this model of transmitting a low volume of highly priced telegrams.⁴⁵

The first terrestrial telegraph lines were laid in the 1840s and 1850s. At first, they were used for military and political communication. They were opened for public traffic in 1849 in Austria, 1850 in Prussia and 1851 in France. Telegraphy soon affected commerce and business. In 1866, the successful completion of a durable transatlantic submarine cable inaugurated a new era of 'instantaneous communication' across oceans. Shortly thereafter, cables were laid from Europe to India, Southeast Asia, Australia, Latin America and Africa.

At the same time, landline systems became denser and stretched into tiny towns in places as disparate as the Ottoman Empire, China and the US West. In the 1880s and 1890s, popular connections were duplicated and even triplicated. The ocean network became increasingly densely linked with landlines. Meanwhile, technological innovations like duplex or quadruplex telegraphy allowed two or even four telegrams to be sent from both ends of the wire simultaneously. By 1903, roughly 406,000 km of submarine cables lay at the bottom of the seas.⁴⁶

Starting in the 1880s, imagined uses of telegraphy pushed scientists and amateurs to experiment with eliminating wires in telegraphy altogether. As Richard Noakes' article explores, the occult played a significant role in inspiring scientists to experiment with transmitting information wirelessly through the ether. By December 1901, Guglielmo Marconi succeeded in sending the first wireless message in Morse code across the Atlantic from Poldhu in Cornwall, England to Newfoundland in Canada. Navies were first most interested in wireless as a means to coordinate their moving ships on the sea. After the Titanic disaster in 1912, the London conference on radiotelegraphy urged for mandatory installation of radios on ships. The conference participants also mandated that all wireless systems had to be compatible. By the end of World War I, wireless telegraphy had become an integral part of warfare. By the early 1920s, vacuum tubes among other innovations had enabled the transmission of live speech and Western countries introduced spoken radio to the public.

Histories of telegraphy have generally focused on the business history of cable companies, technological histories of the cables themselves or political histories of the cables' influence on international relations.⁴⁷ One scholar has recently examined how telegraphy dematerialized information and shifted perceptions of time and space.⁴⁸ Others have explored how states created the first international organization, the International Telegraph Union, to solve the problems of coordinating the transmission of telegrams across borders.⁴⁹ Innovation in telegraphy has been a much disputed field. On the one hand, Bernhard Finn argued that from its beginning, telegraphy was a stagnant technology and that the economic monopoly of a handful of telegraph companies hindered innovation from 'independent' inventors. On the other hand, Richard Noakes demonstrated that research and development remained important within the companies' shops.⁵⁰ Finally, scholars working on the postal system have emphasized the post's continuing importance for the vast majority of the population.⁵¹ They have also shown that much of telegraphy's purported acceleration of time was part of a broader speeding up of transportation since the 1820s, particularly through steamships.⁵²

Although comparatively far less studied than telegraphy, recent work has reinserted wireless as a key element in the history of technology. Two scholars have argued that patents issued for wireless telegraphy helped to create the cult of the individual heroic inventor.⁵³ Others, meanwhile, have used wireless as an example of the 'double birth' model of innovation, because wireless represented the first step in a two-step process of creating spoken radio.⁵⁴ While radio was a mass medium, we cannot understand the emergence of radio without the first step of making wireless into a point-to-many technology. This special issue considers wireless telegraphy as part of telegraphy, partially because imagined uses of submarine telegraphy shaped the development of wireless. Radio emerged directly and indirectly from imagined uses of telegraphy on both sides of the Atlantic, as Richard Noakes explores.

A social and cultural historical approach adds the imagined use of telegraphy to explorations of its actual use. This approach broadens our perspective on societies' interaction with and appropriation of technology. It shows how not only mechanisms of economy,

politics and news, but also religion, gender and knowledge needed to be re-negotiated through the (non-) appropriation of telegraphy as a means of communication. The emergence of telegraphy did not just change business operations or colonial communications. The technology did not just affect users. Non-users interacted with the information sent through telegraphs, for example by reading items sent by telegraph in their newspaper.⁵⁵ Telegraphy also had a large impact on the imagination of the broader public. People who might never walk into a telegraph office to send a telegram still envisioned themselves as participating in a telegraphic future where instantaneous communication might create world peace. Non-users interpreted the role of telegraphy in their daily lives and rethought their perceptions of time and space, even as they never used the technology that inspired those thoughts in the first place.

This special issue on imagined use starts off with Heather Ellis' contribution on 'Marconi, masculinity and the heroic age of science'. Ellis uses the annual meeting of the British Association for the Advancement of Science in 1899 to explore how Guglielmo Marconi staged himself as the ultimate masculine inventor and influenced the ongoing struggle between competing interpretations of invention and innovation as masculine practices within British science. While the British Association as an institution favoured a narrative of scientific research as a collectivist, international, gentlemanly-amateur pursuit, Marconi set it up as achievement of his own genius. Appealing not only to the established scientific elite, but also to a range of non-traditional audiences, and stressing the possibilities or 'imagined uses' of his technology, he succeeded in commanding unprecedented influence.

Richard Noakes' contribution 'Electro-telepathy and spiritualism' explores another non-traditional audience – the Victorian spiritualists who engaged with telegraphy from around 1900. He moves beyond scholarly studies on the metaphorical and analogical uses of electrical communication in telepathy, spiritualism and other psychic phenomena. Noakes illustrates that in British and American cultures there were sincere attempts to translate electrical-psychic analogies into technological thinking and practice. Inspired by debates about telepathy, brain waves and other psychic effects, actors imagined and constructed electrical communication technologies that were meant to address a range of psychic puzzles. Although technologies could in the end not solve the psychic puzzles, they provide striking insights into the role of 'irrational' imaginations for shaping technological development.

Catherine Davies explores another aspect of imagined use in her contribution – that of imagined reception. She analyses how financial agents in the crisis of 1873 employed different means of communication depending upon the kind of reception they imagined this medium would receive alongside the contents of the actual message. While bankers used telegraphic cables to communicate intelligence such as price information, they sent letters to establish personal trust. At the same time, journalists criticized the telegraphs' performance during the crisis, because they found telegraph information insufficient. Davies argues that this criticism was ultimately based on how senders imagined their cables would be received as well as on the persistence of earlier imagined uses of telegraphy as a medium that would create simultaneity and rationalize financial markets. Davies highlights the persistence of earlier imagined uses by juxtaposing telegraphy with the older medium of letters, demonstrating that imagined uses of telegraphy from the 1840s still permeated contemporaries' ideas in the 1870s. 'Imagined use' can thus challenge standard periodizations.

Heidi Tworek, finally, illustrates how fears about others' use of technology can spur innovation. Government elites shaped technological innovation through their beliefs about

potentially nefarious uses of communication long before incidents like Edward Snowden's revelations about the NSA. In Tworek's example, German fears about British use of submarine cables initiated German investment in developing wireless telegraphy. German officials imagined that the British were using cables to damage Germany's reputation abroad, spy on Germany or even 'poison' neutral countries' attitude towards Central Powers. As Tworek shows, the German government first created a colonial wireless network to bypass British cables. During World War I, however, they sought to establish a world wireless network. In the end, technological wireless innovation was significantly influenced by how German elites imagined their enemies' uses of communications technology.

Telegraphy is a technology particularly apt to explore the concept of imagined use and to test its analytical value. Only a minority of people came to use telegraphy as a communicative tool but the technology simultaneously created the informative space necessary for visions of technology to be explored and discussed. Imagined uses of telegraphy also shed new light on the relationship of technology and modernity.

Beyond this special issue's example of telegraphy, the concept of imagined use opens up new interpretative spaces for the history of science and technology. It conveys a sense of the value and validity of particular types of knowledge, methodologies of knowledge creation as well as certain actors involved in processes of knowledge production within the global world of science and technology. Actual uses of technology often reproduced the historical world's power structures of Western male elites and rational understandings of technology. A historical approach to the concept of imagined use, on the other hand, enables us to examine the myriad appropriations of technology. Finally, 'imagined use' provides the promise of integrating distinct strands of historiography that have remained in separate silos up to this point, but which provide fruitful perspectives on technology, such as the history of the future, gender studies and SCOT.

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Notes

1. Weaver, Inside the Weird World of Cryonics.
2. Bijker et al., *The Social Construction of Technological Systems*; Moon, *Social Networks in the History of Innovation and Invention*.
3. Marx, "Technology"; Schatzberg, "Technik Comes to America".
4. Edgerton, "Innovation, Technology, or History".
5. Edgerton, "From Innovation to Use"; Edgerton, *The Shock of the Old*.
6. Winner, "Upon Opening the Blackbox and Finding it Empty," 370.

7. Müller, "Beyond the Means of 99 Percent of the Population". See also Hochfelder, *The Telegraph in America*; John, "Letters, Telegrams, News".
8. The history of consumption has become an important field. See, for example, Trentmann, *Empire of Things*.
9. Turschwell, *Literature, Technology and Magical Thinking*; Goody, *Technology, Literature, and Culture*; Dickens, "On an Amateur Beat"; Twain, "Mental Telegraphy"; Poole, "Henry James and the Mobile Phone".
10. On technology and the subaltern see Headrick, "A Double-Edged Sword".
11. Cave, "Is Predicting the Future Futile or Necessary?"
12. Krige and Wang, "Nation, Knowledge, and Imagined Futures".
13. Ross, *The Industries of the Future*; Häggström *Here Be Dragons*; Batt, *Visions of the Future*.
14. Pursell, "Technologies as Cultural Practice and Production"; Hård and Jamison, *Hubris and Hybrids*; Jamison, *A Hybrid Imagination*.
15. Müller and Tworek, "The Telegraph and the Bank"; Müller-Pohl, "By Atlantic Telegraph".
16. John, *Network Nation*.
17. Ahvenainen, "The Role of Telegraphs".
18. Boyd-Barrett and Rantanen, *The Globalization of News*. Tworek, "Magic Connections".
19. Müller, "Beyond the Means of 99 Percent of the Population".
20. Hughes, *Networks of Power*; Mayntz and Hughes, *The Development of Large Technical Systems*; Oudshoorn and Pinch, "How Users Matter"; Edgerton, "From Innovation to Use"; MacKenzie and Wajcman, *The Social Shaping of Technology*. On critique of the linear model see the contributions by Glen Asner and David Edgerton in Grandin, Wormbs and Widmalm, *The Science-Industry Nexus*.
21. Forman, "The Primacy of Science in Modernity".
22. Latour and Woolgar, *Laboratory life*; Woolgar, "The Turn to Technology in Social Studies of Science"; Dietz, *Technische Intelligenz und 'Kulturfaktor Technik'*. Mazlish, *The Fourth Discontinuity*.
23. Edgerton, "From Innovation to Use: Ten Ecclectic Theses".
24. Fallan, *Design History*, 7.
25. Adamson et al., *Global Design History*.
26. Dilnot, "The State of Design History"; Dilnot, "The State of Design History Part II"; Clark and Brody, "The Current State of Design History".
27. Winner, "Upon Opening the Blackbox and Finding it Empty". Similar critique was also voiced by Russell, "The Social Construction of Artefacts".
28. Ross, *The Industries of the Future*; Häggström *Here Be Dragons*; Batt, *Visions of the Future*.
29. Giddens, "Runaway World"; similarly Kossellek, *Modernity and the Planes of Historicity*.
30. Luhmann, *Soziologie des Risikos*.
31. Engel, "Buying Time".
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