

To be connected: perspectives on autonomy and risk from the Electric Age

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image caption 1:

'She travels without moving across annihilated space...'

L'inhumaine. Directed by Marcel L'Herbier, 1924. Archive: Lobster Films.

In *Dreams Rewired*. Directed by Manu Luksch, Martin Reinhart, and Thomas Tode, 2015.

Electrification around the turn of the 20th century occurred within a broad context of modernisation - from innovation in manufacturing and tooling and the rise of the petroleum and chemical industries, to medical advances precipitated by the new germ theory of disease. Technological revolution and social reform swept parts of Europe and America, recasting the domestic, public and industrial spheres - though elsewhere, extractive colonialism intensified.

The 1870s saw the invention of both the electric telephone and the incandescent light bulb; power stations were established in the 1880s in London and New York, predominantly supplying building and street lighting; and in 1896 Marconi patented his wireless telegraph, to achieve transatlantic communications just five years later. By promising progress for all through the proliferation of affordable devices, appliances and communication channels, the 'Electric Age' sparked a fervent utopianism in the public imagination. Already in 1852, one author anticipated 'a future period, when a perfect network of electrical filaments will overspread every civilised land in the world [...] destined to consolidate and harmonize the social union of mankind [...] to draw all nations into more intimate connexion, and to convert the whole human race into one society.'¹

The essay film *Dreams Rewired* (Manu Luksch, Martin Reinhart, Thomas Tode, 2015) reveals how the appetites, anxieties and social convulsions of today's hyper-mediated world were prefigured in the electric media boom at the dawn of the 20th century. It is assembled from nearly 200 film clips dating from the 1880s up to the 1930s obtained through several years' research in over 50 archives. *Dreams Rewired* executes a 'double exposure of past (archive footage) and present (contemporary voiceover),'² the diverse footage - from early dramas and newsreels, to educational films, records of scientific experiments, and artistic adventures with new media - being articulated and questioned by Tilda Swinton's mercurial narration and the musical score.

This text returns to the pool of archival material that the film directors worked with, and expands on the film's thesis. Early electric media promised empowerment in the face of accelerating change, just as our personal smart devices do today. But hopes were curbed by fears - of the erosion of privacy, of ubiquitous surveillance, of financial exposure and moral hazard - that are

¹ Michael Angelo Garvey. *The Silent Revolution: Or, the Future Effects of Steam and Electricity upon the Condition of Mankind* (London: William & Frederick G. Cash 1852), pp.103-104. He then continued, 'Is this consummation to be looked forward to as a good, or to be dreaded as an evil?'

² Bodil Marie Stavning Thomsen. 'Dreams Rewired: Disembodying Data and Rematerialising Technology'. Essay in booklet accompanying *Dreams Rewired* DVD (Icarus Films Home Video, 2016).

strikingly familiar today. In what follows, we exercise these resonances and induce the historical cinematic record to articulate contemporary desires, capabilities, and concerns.

Part 1 introduces the key transformation of the Electric Age - the overcoming of distance - and the moral risks that have arisen with its intensification today. Part 2 explores notions of simultaneity, then and now, particularly with respect to financial risk. Part 3 examines the material substrate and global political economy underlying electric dreams, while in Part 4, we consider the impact of new technologies in the domestic and corporate contexts, and the realities of the 'smart' home and 'intelligent' workplace today. In Part 5, we discuss how the historical enclosure of the electromagnetic commons in the US is mirrored in the battle over net neutrality. The concluding Part 6 traces the roots of contemporary surveillance capitalism,³ which is characterised in part by the creation of a futures market in human behaviour, back to the early 20th century pursuit of efficiency.

³ As theorised and popularised by Shoshanna Zuboff in S. Zuboff, *The Age of Surveillance Capitalism* (London: Profile Books, 2019).

1 TOWARDS DISTANCE ZERO

*By overcoming distance, we overcome difference.*⁴

Live connectivity, instantaneous global presence, being everywhere at once – the imminent annihilation of space was clearly foreseen in the newly-electrified late Victorian era. Real-time, bidirectional, audio-visual communications would foster empathy, compassion, and world peace – a televisual utopia. Although much of the technology was perfected only later in the 20th century, it was already dramatically envisioned in early science fiction such as Albert Robida's *Le Dix-Neuvième Siècle: La vie électrique* (1890)⁵. In Robida's novel, the young protagonist Hélène inhabits a gender-equal future transformed by electricity, telephonoscopes,⁶ and aero-transport. Such radical visions were driven by the no-less radical transformations of everyday life. An incredible vanquishing of distance had been brought about by the establishment of a reliable undersea transatlantic link in 1866. The cable brought New York and London strikingly closer with an eight words-per-minute telegraph service⁷ – before it, the cities had been twelve days apart. An increase in communication speed of this order, of 10,000-fold⁸, was unprecedented, and would not be seen again until the 1990s.⁹

By the early 1900s, the telephone had brought real-time bidirectional transmission of speech to millions of homes.¹⁰ In the public imagination, it could only be a matter of time before images would accompany sounds over wires. But electrical 'seeing at a distance' remained in its experimental stages through the 1920s. Cinema closely approximated real-time image transmission through newsreels and horse racing reports. Fiction films furnished convincing, if sometimes wildly speculative, simulations of the televisual. Such visions were often depicted using a fantastic electric variation on the telescope – a 'core optical device in early cinema', according to media theoretician and archaeologist Trond Lundemo, that often incorporated aspects of radio and recording technology¹¹. The circular matte signifying a telescopic view became a common cinematic trope to depict seeing over distance.

In spite of their globalising vision, the televisual utopias of early cinema were compromised by their perpetuation of existing hierarchies and prejudices, in particular of race. A vivid example is found in the Danish film *Dr. Ams Tram Grams Kikkert* (c.1908, author unknown). While a

⁴ *Dreams Rewired*. Directed by Manu Luksch, Martin Reinhart, and Thomas Tode, 2015.

⁵ Translated by Philippe Willems as A. Robida. *The Twentieth Century* (Middletown: Wesleyan University Press, 2004).

⁶ Robida's term for a videophone

⁷ M. Schwartz & J. & Hayes. 'A history of transatlantic cables'. *IEEE Communications Magazine*, vol. 46, no. 9 (September 2008), p.44. doi: 10.1109/MCOM.2008.4623705.

⁸ The *Titanic's* top speed was about 40 km/h; human swimmers can reach 8km/h over short distances.

⁹ Twelve days is approximately 18,000 minutes, so for any message longer than about 140,000 words, a ship would still be faster than telegraphy at 8 words per minute. Given a realistically short message, however, the telegraph was faster than a ship by a factor of about 10,000. A communications rate 10,000 times that of the early telegraph would be 80,000 words per minute, which is very approximately 400,000 characters per minute, or about 50 kilobits per second. Such a rate would become publicly available in the late 1990s via V.90 standard modems.

¹⁰ In the USA alone there were over two million telephone subscribers in 1902.

Telephones and Telegraphs 1902. Department of Commerce and Labour Bureau of the Census Special Report (Washington: Government Printing Office, 1906), p. 5

¹¹ Trond Lundemo. 'The dissected image: the movement of the video' in J. Fullerton & J. Olsson, eds. *Allegories of Communication. Intermedial concerns from cinema to the digital*. (Rome: John Libbey, 2004), p. 109.

European inventor awaits a guest to whom he will demonstrate his 'electric telescope', his Asian servant sneaks a look. Live images from 'exotic' locations stream back to the remote seer, who can also rewind and fast-forward images at will – the instrument is a time machine of sorts. This is a one-way instrument, however, and the evident 'superiority' of western civilisation is mirrored in the humiliation that the inventor heaps upon his servant on catching him.



image caption 2:
Dr. Ams Tram Grams Kikkert. Director unknown, ca. 1907-09. Archive: Sveriges Television AB. In Dreams Rewired.

Today's reconnaissance drones and Earth observation satellite take remote seeing – and the surveillant stance – to new extremes. Weather prediction, climate modelling, environmental monitoring (for example, of desertification or sea ice cover), and cartography all depend on remote sensing by satellites. Constellations of these satellites, each weighing tons and costing several hundred million dollars, image the globe in near-realtime, in the visible and also the infrared and ultraviolet portions of the spectrum. Civilian satellites can resolve details on the order of a few metres¹²; the data downlinked to ground stations is accessible within hours of a satellite imaging an area¹³. Rewinding history is as simple as travelling through the archive; on the other hand, fast-forwarding the future is only possible through computer extrapolations that produce, at best, weather projections for the next few days.

*The globe shrunk to the size of a village –
 Neighbours united in electric dreams?*¹⁴

From its first incursions into the domestic sphere, technology had promised to connect friends and family in diaspora; concomitantly, the trope of the 'telescopic view' evolved to symbolise psychological distance and the pain of separation. Edwin S. Porter's *Life of an American Fireman* (1903) opens with a scene of a fireman at work dreaming of his wife and child, who will later become the subjects of a rescue operation as their house burns. The round matte bounding his 'mind's eye view' is mirrored in a 2018 ad from Samsung's 'Be Together' Christmas campaign. A flying doctor, en route to an emergency, glances at her smartwatch whose round face frames a portrait of her family. 'If you can't be together,' chimes the slogan, 'be together with Galaxy.'¹⁵

¹² See for example <https://www.euspaceimaging.com/products/image-specs/>

¹³ C. Liu et al, 'Near Real-time Browsable Landsat-8 Imagery', *Remote Sens.* 2017, vol. 9, no. 1 <https://doi.org/10.3390/rs9010079>
 Commercial services include 'FarEarth Observer.'
<http://live.farearth.com/observer/>

¹⁴ *Dreams Rewired.* Luksch, Reinhart, and Tode, 2015.

¹⁵ But note that 'wireless network and pairing with compatible Samsung Galaxy required. Requires SmartThings App, smartbulb/outlet and SmartThings Hub'. *Be Together: Even if You're Working Christmas Commercial.* Samsung, 2018. Accessed 20 December 2019.
<https://www.youtube.com/watch?v=G8Et86NhGuo>



image caption 3:
Life of an American Fireman. Directed by George S. Fleming and Edwin S. Porter, 1903.
 Archive: Library of Congress.
 In *Dreams Rewired*.

Some televisual fantasies went far beyond merely connecting friends and family, instead projecting a worldwide community of creators, communicators and consumers of ideas. In Marcel L'Herbier's 1924 film *L'inhumaine*, the glamorous Parisian singer Claire craves the attention of a global audience and plans an extended concert tour. The inventor Norsen is infatuated with her and desperately seeks to prevent her departure. He develops a wireless system that can broadcast her voice to the world and simultaneously receive live televisual images of audience reactions back in the lab.



image caption 4:
 Live televisual feedback from a Middle-Eastern audience.
L'inhumaine. L'Herbier, 1924.
 In *Dreams Rewired*.

In an economy that is information-rich but attention-poor, visibility is currency. Today's video-enabled social media platforms promise to effortlessly fulfil Claire's desires. 'Our mission is to give everyone a voice and to show them the world', YouTube claims¹⁶. No inamorato or svengali necessary, this is the age of the amateur and the influencer. And as the instruments and objects of this economy become ever more abstract, so audience engagement becomes increasingly frictionless. The Instant Famous Socials Shop sells 50,000 YouTube 'views' and 500 'real likes' for £109.66 (availability: in stock).¹⁷ Twitter Followers Packages ('high-quality followers with lifetime

¹⁶ YouTube Mission statement at <https://www.youtube.com/intl/en-GB/about/>
 Accessed 28 April 2020.

¹⁷ 'Instant Famous Social Shop'. Accessed 20 December 2019.
<https://instant-famous.com/products/10000-youtube-views>

guarantee') are, somewhat mysteriously, sold out.¹⁸ Attention vendors spawn an abundance of online identities, accounts and bots to generate interest, 'favourite' customers and retweet their conversations. The mere semblance of popularity suffices, apparently.

But it would be cynical not to acknowledge the continued salience of radical social vision mediated through technology. Even as practical television was being perfected, the electric communication of data other than sound and images had already been imagined. In Arthur Berger's *Die vom 17er Haus* (1932), commissioned by the Sozialdemokratische Arbeiterpartei in the run-up to elections, three generations exchange knowledge, with the grandfather transmitting an archive over an international data link. Despite the growing instrumentalisation of the Internet for commercial purposes, early world wide web dreams of nonhierarchical distributed knowledge and communication live on in protocols such as BitTorrent, a P2P (peer-to-peer) file sharing scheme. BitTorrent declares itself a 'free speech tool' that extends the freedom to publish to those without significant capital or equipment. 'Cooperative distribution can grow almost without limit, because each new participant brings not only demand, but also supply.'¹⁹ Currently, another peer-network based technology, blockchain, is inspiring activists and entrepreneurs alike. Blockchain allows trust to be distributed transparently among peers - any one of which can validate a data transaction.²⁰



image caption 5:
 "Please accept the transfer." From peer to peer, messages between equals.'
Die vom 17er Haus. Directed by Arthur Berger, 1932). Archive: Österreichisches Filmmuseum. In *Dreams Rewired*.

In the public imagination, fantasies of wireless transmission included the conveyance of not only data, but also matter and motion. Louis Seel's *Wiener Bilderbogen Nr. 1* (1925) humorously explores the power of radio to transmit not only sound, but also heat (a Saharan breeze is

¹⁸ 'Instant Famous Social Shop'. Accessed 20 December 2019. Still sold out on 28 April 2020.

<https://instant-famous.com/collections/twitter-followers>

Mysterious because there is evidently no scarcity; another vendor, InstaFollowers has in stock both 'real Twitter followers' and 'realistic-looking high-quality followers':

<https://www.instafollowers.co/buy-twitter-followers>

Accessed 28 April 2020.

Unlimited reproducibility with perfect fidelity, together with precisely controllable mutability, and signal encoding that permits access control and error correction, are characteristic of the networked digital realm. Scarcity of digital goods must be created artificially, through technical mechanisms. See for example:

John L. Sullivan. 'Software and Artificial Scarcity in Digital Media'. *The Political Economy of Communication* 4(1), 66-84

<http://www.polecom.org/index.php/polecom/article/view/64/254>

and also

R. O'Dwyer. 'Limited edition: Producing artificial scarcity for digital art on the blockchain and its implications for cultural industries'. *Convergence: The International Journal of Research into New Media*.

<https://doi.org/10.1177/1354856518795097>

¹⁹ As a torrent user downloads data from available sources across the network, so they also republish it. 'BitTorrent.org For Users.' Accessed on December 20 2019.

<https://www.bittorrent.org/introduction.html>

²⁰ A non-technical introduction to blockchain can be found in Antony Lewis. *The Basics of Bitcoins and Blockchains* (Coral Gables: Mango, 2018).

diverted to warm the elegant woman protagonist) and kinetic energy (a slap, delivered to her husband's lover).



image caption 6:

'Radio-mechanically, she gets dressed. Radio-optically, she surveys her faithful husband. And radio-mechanically, she strikes her detested rival.'

Wiener Bilderbogen Nr. 1.
Directed by Louis Seel, 1925.
Archive: Filmarchiv Austria.
In *Dreams Rewired*.

Wireless control of mechanisms over distance was first realised by the end of the 19th century, Nikolai Tesla famously demonstrating a remotely-steered boat in New York in 1897.²¹ Military applications had already been imagined; much early research was motivated by the desire to steer torpedoes to their targets. The slap in Seel's film, simultaneously intimate and remote, finds its darkest contemporary in the drone strike – 'surgically'²² clean from the perspective of the operator, but an unaccountable violence on the part of the receiver. Modern weapon systems increasingly involve remotely-controlled or autonomous UAVs (unmanned aerial vehicles) – the US government has deployed armed drones in thousands of 'targeted killings' (extrajudicial assassinations) since 2001, even marking one of its own citizens for 'termination' in 2010.²³ Drone wars are played out in an aggressively asymmetrical theatre, directed by joystick warriors in the ultimate gaming setup, simultaneously amped up and narcotised by screens in windowless rooms far from the conflict zone. The trauma inflicted in the battlefield eventually filters back as moral injury and psychic damage to the operators, inexplicable violence in the

²¹ Benjamin Franklin Miessner, *Radiodynamics. The Wireless Control of Torpedoes and Other Mechanisms* (New York: D. Van Nostrand Company, 1916), 83–84.

²² John Brennan, President Obama's former chief counterterrorism adviser and now director of the CIA, has praised drones' "surgical precision" and "unprecedented ability" to distinguish between terrorists and civilians.⁷
https://publications.parliament.uk/pa/cm201314/cmselect/cmdfence/772/772vw08.htm#footnote_7

Although 'surgical' is apt and convenient description of drone operations, the terminology predates modern drone warfare. Writing in 1986, William Safire defined a 'surgical strike' as 'precise, quick, clean, incisive.

W. Safire. 'On Surgical Strike.' *New York Times*, 4 May 1986.

<https://www.nytimes.com/1986/05/04/magazine/on-language-on-surgical-strike.html>
Accessed 5 May 2020.

²³ Greg Miller, 'Muslim cleric Aulaqi is 1st U.S. citizen on list of those CIA is allowed to kill'

Washington Post, 7 April 2010. Accessed on 20 December 2019.

<https://www.washingtonpost.com/wp-dyn/content/article/2010/04/06/AR2010040604121.html>

field and PTSD at home knitted together through telepresence.²⁴ In a future in which the agents of war are fully autonomous 'killer robots'²⁵, accountability will be even murkier, and the risks correspondingly more extravagant.

²⁴ Eyal Press, 'The Wounds of a Drone Warrior', *The New York Times Magazine*, 13 June 2018. Accessed on 20 December 2019.

<https://www.nytimes.com/2018/06/13/magazine/veterans-ptsd-drone-warrior-wounds.html>

For differing perspectives on the mechanisms of psychological and moral harm caused to drone operator, and the legitimacy of diagnoses of PTSD, compare:

Chris Woods. *Sudden Justice: America's Secret Drone Wars* (London: C. Hurst & Co., 2015). p.169ff.

and

Grégoire Chamayou. *Drone Theory* (London: Penguin, 2015).

²⁵ For a pithily humorous assessment of the feasibility of autonomous weapon systems from a mathematician, see Kevin Buzzard. 'Killer Robots: What Computers Can't Do'. Royal Institution Lecture, January 2017. Available at:

<https://www.youtube.com/watch?v=jQPb7DRMoZY>

For a wide-ranging, book-length discussion see Paul Scharre. *Army of None: Autonomous Weapons and the Future of War* (New York: W. W. Norton & Co., 2018).

2 SIMULTANEITY

As real-time telecommunication became a reality, cinema faced the challenge of narrating simultaneity through techniques such as the depiction of telephones on screen, cuts between different locations, and split-screen.

*On screen, and on the phone - tells us: at the same time, but not in the same place.*²⁶

Dreams Rewired crosscuts several suggestively-named films from the 1910s that represented simultaneity through the telephonic experience (*An Unseen Enemy*, *The Lonely Villa*, *Terrible Angoisse*,...). In *Suspense* (Lois Weber, 1913) a triangular split-screen shows a distressed new mother on the phone to her alarmed husband at work, while a tramp intent on breaking and entering the house saws away at the telephone cable.



image caption 7:
Suspense. Directed by Lois Weber, 1913.
In *Dreams Rewired*.

Once the telephone enabled simultaneity; today, accurate synchronisation between locations is a prerequisite for voice and data transmission. Digital networks are 'clocked' using standardised time signals from global navigation satellite systems (GNSS)²⁷ such as the American GPS and Russian GLONASS. Each GNSS satellite contains several atomic clocks that are synchronised with Earth-bound clocks; a receiver deduces its own position and the exact time from multiple satellite time signals and information on the satellites' positions. Beyond its application in navigation and communication networks, GNSS time coordination is vital in industries such as energy and finance.²⁸

Electric cables carry signals at 50-90% the speed of light, c (approximately 300,000 kilometres per second), and radio waves travel at c - which is the speed limit of the universe. Because of

²⁶ *Dreams Rewired*. Luksch, Reinhart, and Tode, 2015.

²⁷ A comprehensive description of GNSS technology can be found in B. Hofmann-Wellenhof, H. Lichtenegger & E. Wasle. *GNSS - Global Navigation Satellite Systems* (Vienna, 2008: Springer).

²⁸ Official US government information that summarily describes GPS applications can be found at:

<https://www.gps.gov/applications/timing/>

For an economic assessment of the role of GNSS in critical infrastructure that discusses applications in more detail, see the UK-government-commissioned report 'The economic impact on the UK of a disruption to GNSS'. London Economics (June 2017), available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/619544/17.3254_Economic_impact_to_UK_of_a_disruption_to_GNSS_-_Full_Report.pdf

On the crucial dependence of financial markets on GPS-derived time signals, see T. Humphreys. 'GPS Spoofing and the Financial Sector', The University of Texas at Austin Radionavigation Laboratory White Paper (June 2011). https://radionavlab.ae.utexas.edu/images/stories/files/papers/summary_financial_sector_implications.pdf Accessed 28 April 2020.

this speed limit, even information takes time to travel over distance. In the 21st century, location becomes important once again, in the form of distance to stock exchange or data centre. High frequency trading (HFT) algorithms used by financial firms can exploit nanosecond discrepancies in access to price information for dramatic profit – at the expense of market stability. UK Government research following the 2010 Flash Crash, which was characterised by rapid, extreme price movement, described HFT ‘essentially as an accelerator to [...] market dynamics such as bubbles and crashes’.²⁹ A recent paper concludes that although HFT algorithms could theoretically provide liquidity to moderate crashes, they ‘strongly contribute to exacerbating the consequences’.³⁰



image caption 8:
L'Argent. Directed by Marcel L'Herbier, 1928. Archive: Marie-Ange L'Herbier. In *Dreams Rewired*.

The negative consequences of financial speculation accelerated by high-speed communications³¹ were anticipated and played out fully in L'Herbier's extravagantly-produced *L'Argent* (1928), based on Zola's novel of the same name. L'Herbier filmed for three days in the Paris Bourse, flying cameras around the bodies of frenzied traders. Amongst them is the protagonist, who has a fortune riding on an audacious plan for exploiting natural resources from the New World. The progress of an aviator, crossing the Atlantic en route to discovering mineral wealth, is relayed back to the Bourse by radio. While today financial advantage may be conferred by a few metres differential in distance to the exchange,³² for L'Herbier's protagonist, dominance required bridging a far greater distance – between colony and metropole.

²⁹ Government Office for Science, 'Crashes and high frequency trading' (2011), 4. Accessed on 20 December 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/289016/11-1226-dr7-crashes-and-high-frequency-trading.pdf

³⁰ Mario Bellia et al, 'High-Frequency Trading During Flash Crashes: Walk of Fame or Hall of Shame?' (2018), 2. Prepublication. Accessed on 20 December 2019. https://www.eurofidai.org/sites/default/files/pdf/parismeeting/2018/BELLIA_2018.pdf

³¹ For a survey of the challenges posed by high frequency trading, see W. Mattli (ed.). *Global Algorithmic Capital Markets. High Frequency Trading, Dark Pools, and Regulatory Challenges* (Oxford: OUP, 2018).

³² See M. Zook & M. H. Grote. 'The microgeographies of global finance: High-frequency trading and the construction of information inequality'. *Environment and Planning A: Economy and Space*, vol. 49, 1: pp. 121-140.

3 THE MATERIAL SUBSTRATE



image caption 9:

'It wasn't a free ride - someone had to lift us up.'

Filmes d'exposition ethnographiques de l'Afrique occidentale au Champ-de-Mars à Paris. Directed by Félix Regnault, Charles Comte, and Étienne-Jules Marey, 1889. Archive: La Cinémathèque française.

In *Dreams Rewired*.

Shot in a 'human zoo' displaying colonial subjects imported for the metropolitan gaze, the *Filmes d'exposition ethnographiques de l'Afrique occidentale au Champ-de-Mars à Paris* (1889) brazenly depicts differential economic development at the height of the European 'scramble for Africa'. Under colonial rule, occupied territories exported primary commodities for European consumers and raw materials for European industry, often through the use of forced labour.³³ Commodity products of manufacturing were sold back to the colonies, displacing local industry³⁴, while newly-developed communications and military technologies were deployed by the ruling powers to maintain coercive control. As colonial extraction supported European development, it also exacerbated the technological gap. In the case of African nations, this history continues to blight their development.³⁵

From the mid-19th century, there was boom in demand for rubber and gutta-percha to insulate telegraph wires and undersea cables. Rubber came from plantations in Brazil and vines of French Congo and 'Congo Free State', while gutta-percha was harvested from the wild *Isonandra* tree of the Malay Archipelago. Although fast growing, a single *Isonandra* tree could yield only a

³³ Ewout Frankema, Jeffrey Williamson & Pieter Woltjer. 'An economic rationale for the African scramble'. 14 July 2015
<https://voxeu.org/article/economic-rationale-african-scramble>
 Accessed 1 May 2020.

³⁴ Gareth Austin. 'African Economic Development and Colonial Legacies.' *International Development Policy* 1 (2010), pp. 11-32.
<https://doi.org/10.4000/poldev.78>

³⁵ For a searing indictment, see Walter Rodney. *How Europe Underdeveloped Africa* (London: Verso, 2018).

few hundred grams of latex due to crude extraction methods employed³⁶. Insulating the 1857 transatlantic cable required nearly 300 tons of gutta-percha³⁷, equivalent to the destruction of the order of a million trees. By the 1880s, the booming demand for gutta-percha threatened to wipe out the tree³⁸. The beneficiaries of colonialism – the architects of new industrial society and early adopters of electrical technology – were for the most part insulated from this environmental degradation, and also from the miserable, often murderous conditions of extraction. Occasionally, though, the material conditions of production did hit public consciousness, as during the 1889 strike at the Silvertown gutta-percha works in East London.³⁹



image caption 10:
By the early 20th century, the demands of telegraphy and telephony had created an enormous cable industry. *50 Jahre Fernsprechen in Deutschland*. Produced by Directed by W. Achsel & Co. Filmproduktion, 1933. Archive: Siemens Historical Institute, München. In *Dreams Rewired*.

Ephemeral and apparently inconsequential, our online actions – searches, tweets, likes, and tinder swipes – are realised on an undeniably material substrate. End users are well-shielded from the provenance of their electronic devices, which are built with the 3TG conflict minerals (tantalum, tin, tungsten and gold) extracted in the Democratic Republic of Congo⁴⁰, and lithium pumped out from beneath the Atacama desert at huge water cost⁴¹. These metals end up in microchips and batteries manufactured by enormously complex and meticulous processes that demand corrosive or toxic reagents including organic solvents, acids, bases, and photoresist

³⁶ Bruce J. Hunt, 'Insulation for an Empire: Gutta-Percha and the Development of Electrical Measurement in Victorian Britain' in Frank A. J. L. James, ed., *Semaphores to Short Waves* (London: RSA 1998). p. 92

³⁷ Charles Bright, *Submarine Telegraphs: Their History, Construction, and Working* (London: C. Lockwood & Son, 1898), p.35.

³⁸ This was intimated by Eugene Obach in his Cantor Lectures. E. F. A. Obach 'Gutta Percha' (Cantor Lectures: Lecture I), *The Journal of the Society of Arts*, vol. 46, no. 2353 (1897). p. 110. *JSTOR*, www.jstor.org/stable/41334332. Accessed 26 Apr. 2020.

John Tully makes the environmental impact of gutta-percha harvesting central in 'A Victorian Ecological Disaster: Imperialism, the Telegraph, and Gutta-Percha', *Journal of World History*, 20, No. 4 (December 2009): pp. 573-574.

³⁹ Tully, *ibid.* p. 565.

⁴⁰ UN Security Council Resolution 1291 of 2000 made an association between armed conflict and resource extraction in the DRC – an association that is acknowledged in U.S. law. Section 1502 of the U.S. Dodd-Frank Act (2010) requires companies to exhibit 'due diligence' and produce independent audits of their use of conflict minerals.

⁴¹ For a summary article, see Ben Heubl. 'Lithium firms depleting vital water supplies in Chile, analysis suggests', *Engineering and Technology* (21 August 2019). <https://eandt.theiet.org/content/articles/2019/08/lithium-firms-are-depleting-vital-water-supplies-in-chile-according-to-et-analysis/>

For a more technical treatment, see W. Liu, D. B. Agusdinata, S. M. Myint, 'Spatiotemporal patterns of lithium mining and environmental degradation in the Atacama Salt Flat, Chile', in *Int J Appl Earth Obs Geoinformation* 80 (2019), pp. 145-156.

chemicals, and well as very large quantities of pure water⁴². And the data packets switched by these microelectronics travel through copper cables insulated with today's gutta-percha - polyethylene and polycarbonate, products of a growing petrochemical industry⁴³.

At the other end of the life of microelectronics: industrial strategies of planned obsolescence⁴⁴, exercised in the absence of global legal frameworks on recycling or the right to repair, result in mountains of e-waste, often accumulating in the same regions scarred by mining of the raw material. Cradle-to-grave design? The US Environmental Protection Agency (EPA) estimated that in 2012, the country generated 3.4m metric tons of consumer e-waste (including computer, audio-visual and telecommunications equipment), of which 70% was dumped.⁴⁵

Energetic costs are even less tangible to the end user. By Google's accounts, a single search uses on average 1 kJ of energy, the same as a human body burns in 10 seconds.⁴⁶ With an estimated five billion queries a day,⁴⁷ the daily energy cost of Google search is equivalent to that required by the entire human population for 10 seconds of biological functioning. Studies of the environmental impact of other aspects of the information economy are now emerging. A recent life cycle analysis of 'deep learning' neural network models for natural language processing tasks revealed that the carbon footprint of training a single model, involving thousands of algorithmic iterations on massive data sets, could reach several times that of a car over its lifetime.⁴⁸

Life cycle analyses of electronic products can be forbiddingly difficult, involving deeply each of the extraction, manufacturing and service sectors. Rising efficiency - of processors, of manufacturing processes - is not an unequivocal environmental good; it can drive demand and

⁴² For microchip production, see E. Williams, R. Ayres & M. Heller, 'The 1.7 Kilogram Microchip: Energy and material Use in the Production of Semiconductor Devices', *Environ. Sci. Technol.* vol. 3, (2002), pp. 5504-5510.

For battery production, see for example Argonne National Laboratory Energy Systems Division, 'Material and Energy Flows in the Production of Cathode and Anode Materials for Lithium Ion Batteries', report no. ANL/ESD-14/10 Rev (2015). Available at: <https://anl.app.box.com/s/afw5c0u7w43rr5gyfys4r1zjfyw5q14>

⁴³ Increasing demand for plastics is the largest driver of growth in the petrochemical industry, according to the International Energy Agency. See IEA, *The Future of Petrochemicals* (Paris: IEA, 2018). <https://www.iea.org/reports/the-future-of-petrochemicals>

⁴⁴ Particularly for contemporary technology platform providers, planned obsolescence of hardware may be a vital part of a strategy that includes management of scarcity in the realm of software (data formats or operating systems). For an analysis that tempers this business model (using Apple as an example) with the qualities of one based on service contracts, see Tim Kessler & Jan Brendel. 'Planned Obsolescence and Product-Service Systems: Linking Two Contradictory Business Models.' *Journal of Competence-Based Strategic Management* 8, 29-53. 10.1688/JCSM-2016-01-Kessler

⁴⁵ US Environmental Protection Agency Office of Resource Conservation and Recovery EPA, 'Municipal Solid Waste Generation, Recycling and Disposal in the United States, 2012' (2014), tables 12-13. Accessed on 20 December 2019. https://www.epa.gov/sites/production/files/2015-09/documents/2012_msw_dat_tbls.pdf

⁴⁶ Urs Hölzle, 'Powering a Google Search', Google Official Blog, 11 January 2009. Accessed on 20 December 2019. <https://googleblog.blogspot.com/2009/01/powering-google-search.html>

⁴⁷ 'Google now handles at least 2 trillion searches per year', *Search Engine Land*. Accessed on 20 December 2019. <https://searchengineland.com/google-now-handles-2-999-trillion-searches-per-year-250247>

⁴⁸ Emma Strubell, Ananya Ganesh, and Andrew McCallum, 'Energy and Policy Considerations for Deep Learning in NLP' (2019). Prepublication. Accessed on 20 December 2019. <https://arxiv.org/abs/1906.02243>

increase overall consumption⁴⁹. Negative externalities abound; resource and energetic costs and the conditions of labour remain invisible to the average end user. Only occasionally do they surface - for example, when assembly line workers are driven to suicide.⁵⁰

⁴⁹ This effect is known as Jevons Paradox.

⁵⁰ 'Foxconn Suicides - 2010', *Business and Human Rights Resource Centre*. Accessed on 20 December 2019.
<https://www.business-humanrights.org/en/foxconn-suicides-2010>

4 CONTRIVANCE

*Automatic, push-button, remote control.*⁵¹
*Things of the future, now in our homes.*⁵²

An electric future of convenience and leisure through automation was announced at the 1900 World Expo in Paris. Exhibitors promised emancipation from everyday drudgery through the delegation of labour to machines, from moving walkways⁵³ and electric cars⁵⁴ to food vending machines⁵⁵ – an inspiration to filmmakers. Through stop-motion animation in films such as Segundo de Chomón's *El hotel eléctrico* (1908), audiences could imagine a life of leisure, assisted by self-fastening clothes, remote-controlled furniture, autonomous hair-combs and shoe-brushes, and ambulatory luggage.



Image caption 11: *El hotel eléctrico*. Directed by Segundo de Chomón, 1908. Archive: Pathé. In *Dreams Rewired*.

The 'things of the future' in de Chomón's film are animated as if by magic – the mechanism invisible, like electricity itself. Later cinematic depictions make the motive technology explicit. Buster Keaton's *Electric House* (1922) is similarly populated with animated objects, from a miniature railway for serving meals – anticipating conveyor belt sushi – and an automatic dishwasher, to retractable beds and motorised bath tubs. In the film, Keaton is mistaken for an electrical engineer, and much of the action concerns the installation and malfunctioning of machinery.



image caption 12:
 An automatic dishwasher featured in *The Electric House*. Directed by Edward F. Cline and Buster Keaton, 1922. Archive: Joseph M. Schenck. In *Dreams Rewired*.

⁵¹ The Last Poets, 'Mean Machine', in *This is Madness*, Douglas, 1971. Voiceover from *Dreams Rewired*.

⁵² 69, 'Filter King', in *Sound on Sound*, Planet E, 1993. Voiceover from *Dreams Rewired*.

⁵³ Looping around the Expo site was a 3.5 km-long *troittor roulant*, depicted in *Paris Exposition Reproduced From The Official Photographs* (New York: R. S. Peale Co., 1900), pp. 30-31.

⁵⁴ Swift, clean transport was promised by the Lohner-Porsche electric hybrid car.

<https://www.bie-paris.org/site/en/component/easyblog/entry/a-to-z-of-innovations-at-expos-electric-car?Itemid=1009>

Accessed on 28 April 2020.

⁵⁵ A Chandler. 'The Paris Exposition Universelle of 1900'. Expanded and revised from *World's Fair* magazine, Volume VII, Number 3, 1987. Accessed on 28 April 2020.

<http://www.arthurchandler.com/paris-1900-exposition>

Today's Smart Home market picks up the promise of convenience through automation and takes it much further: things in our homes will talk to each other, creating an aggregate picture of our behaviour, and ultimately anticipating what we want before even we know it. On first sight, a vision of 'smart things' networked into a 'conscious' home is inviting. Samsung's 'Family Hub' promises to 'organize [...] family schedules, entertain, and even see who's at the door'⁵⁶ – in effect, control domestic life, all from the fridge. Self-stocking, it short circuits the grocery run. Other vendors offer alternative home operating systems, in which the command centre is a thermostat or loudspeaker rather than a kitchen appliance. All these versions share a goal of nudging consumer desire and enabling frictionless consumption. Early cinema tempered the extravagant optimism of the age by warning not only of electricity's corrosive effects on modesty and privacy, but ominously, of dire consequences when reckless humans command automata. Both de Chomón's and Keaton's films end in chaos wrought by imperfect agents (drunk in the first case, vengeful in the second) in charge of powerful machines. As our machines, devices and objects gain 'smartness'⁵⁷, the risks become systemic and deeper. The boons of convenience, choice, and service are underwritten by contracts (tl;dr)⁵⁸ that deliver intelligence *on us* to the vendors as monetisable data.⁵⁹ Among other freedoms, the pact with 'smart' releases us from legacy notions of ownership, including the right to modify or repair the things around us.⁶⁰ Everyday infrastructure is not above suspicion – as the prescient Philip K. Dick exposed in his novel *Ubik*,⁶¹ when Joe Chip finds himself in a contractual face-off with his 'smart' door.

An alternative future domestic sphere based on social rather than technological change was proposed by Alice Guy-Blaché, the first director of narrative film,⁶² in several of her works. *Les Résultats du féminisme* (1906) inverts traditional gender roles, daring to imagine the woman of the house putting her feet up, drink and pipe in hand, as her manservants frantically sew and iron in the background. Guy-Blaché would later encounter barriers to recognition due to her

⁵⁶ 'Samsung.com Smart Fridge Freezers'. Accessed 20 December 2019.
<https://www.samsung.com/uk/refrigerators/family-hub-fridge-freezers>

⁵⁷ O. Halpern, M. Robert, & B. D. Geoghegan. 'The Smartness Mandate: Notes toward a Critique.' *Grey Room*, (68), 2017: pp. 106-129. On p. 108, the authors characterise smartness as 'inextricably tied to the language of crisis', and 'opportunities to decentralize agency and intelligence by distributing it among objects, networks, and life forms.' Accessed 9 May 2020.
https://kclpure.kcl.ac.uk/portal/files/93233599/2017_Halpern_Mitchell_Geoghegan_Smartness.pdf

⁵⁸ Too Long, Didn't Read

⁵⁹ See J. A. Obar & A. Oeldorf-Hirsch. 'The Clickwrap: A Political Economic Mechanism for Manufacturing Consent on Social Media'. *Social Media and Society* (19 July 2018).
<https://doi.org/10.1177/2056305118784770>

⁶⁰ In the US, the 'right to repair' movement gained significant support from farmers who were prevented from repairing equipment by manufacturers deploying the Digital Millennium Copyright Act (DMCA). The battle is ongoing: www.bloomberg.com/news/features/2020-03-05/farmers-fight-john-deere-over-who-gets-to-fix-an-800-000-tractor

⁶¹ Philip K. Dick, *Ubik* (New York: Doubleday, 1969). Chip is held up by his own front door – a door that is aware of its contractual rights.

⁶² The profession of film director – as distinct from filmmaker – emerged only through specialisation and separation of tasks. Alice Guy-Blaché explicitly restricted herself to a directorial capacity, delegating cinematography and lighting to others. However, film historians didn't acknowledge her as *director* for many decades, as it was common practice to credit only the production company.

gender, despite authoring around 700 films and running successful studios.⁶³



image caption 13:
Les Résultats du féminisme. Directed by Alice Guy-Blaché, 1906. Archive: Gaumont.
 In *Dreams Rewired*.

Indeed, although women had entered the workforce in large numbers in the early 1900s, it was primarily in traditionally 'female' roles of teacher, nurse or secretary⁶⁴. With the outbreak of war and the demand for soldiers, women began to occupy positions in industry and engineering that had been previously denied them, though this trend was partially reversed as men returned from the front lines⁶⁵. And while the advances of the electric age undoubtedly broadened opportunities, roles within the new economy were strongly limited by existing sociocultural attitudes. For example, women were preferred as telephone operators because they were better acculturated to be patient and polite when dealing with customers frustrated by poor connections⁶⁶. A century later, despite unquestionable progress towards gender equality, strikingly similar assumptions about women's capacities prevail in the tech sector. According to Daniel Rausch, head of Amazon's Smart Home division, 'a woman's voice is more "sympathetic"

⁶³ A 2017 report by the American Psychological Association, 'The Changing Gender Composition of Psychology', found that women continue to lack equity in terms of pay and power, even as they have come to dominate the profession in numbers. Accessed on 20 December 2019.

<https://www.apa.org/pi/women/programs/gender-composition/task-force-report.pdf>

The situation in the movie industry is no better - while the proportion of films by female directors is increasing, only one of the 71 Academy Awards for best Director has been awarded to a woman. Accessed on 20 December 2019. <https://womenandhollywood.com/resources/statistics/>

⁶⁴ The American context is described in M. W. Greenwald. *Women, War, and Work: The Impact of World War I on Women Workers in the United States* (Ithaca: Cornell University Press, 1990), pp. 4-11.

⁶⁵ D. Thom. *Nice Girls and Rude Girls: Women Workers in World War 1* (London: I. B. Tauris, 1998), pp. 40-41.

⁶⁶ J. K. Petersen. *The Telecommunications Illustrated Dictionary* (Boca Raton: CRC Press, 2002), p. 883.

and better received'.⁶⁷ Both Alexa and Siri are by default voiced female,⁶⁸ sociologist Safiya U. Noble argues that giving AI (Artificial Intelligence) assistants female voices reinforces gender stereotypes.⁶⁹ Meanwhile, Google serves ads for executive jobs much more frequently to users it identifies as male, according to a 2015 paper by researchers investigating online ad targeting.⁷⁰ The perpetuation of gender disparity in domestic and work contexts through algorithmic management is made all the more dangerous by the invisibility and pervasiveness of the technology employed. The contrivance (device) of the digital assistant must be explicitly disconnected from any contrivance (scheme) to entrench existing socioeconomic inequity.



image caption 14:

'Wanted: young educated ladies.'

Darstellung des Fernsprechverkehrs. Director unknown, ca. 1925-26. Archive: Siemens Historical Institute, München. In *Dreams Rewired*.

⁶⁷ Hannah Schwär and Ruqayya Moynihan, 'There's a clever psychological reason why Amazon gave Alexa a female voice', *Business Insider Deutschland*, 15 September 2018.

<https://www.businessinsider.com/theres-psychological-reason-why-amazon-gave-alexa-a-female-voice-2018-9>
Accessed on 20 December 2019.

Similar reasoning is widespread through the industry; see for example:

Jessi Hemptele J. Hempel, 'Siri and Cortana Sound Like Ladies Because of Sexism', *Wired* magazine (28 Oct 2015).

<https://www.wired.com/2015/10/why-siri-cortana-voice-interfaces-sound-female-sexism/>

Accessed 30 April 2020.

⁶⁸ Siri defaults to male when the operating system language is set to Arabic, French, Dutch or British English. UNESCO and EQUALS Skills Coalition, 'The Rise of Gendered AI and its Troubling Repercussions', in *I'd blush if I could: closing gender divides in digital skills through education* (UNESCO: 2019), 116. Accessed on 20 December 2019.

<https://unesdoc.unesco.org/ark:/48223/pf0000367416>

⁶⁹ As reported in Emily Lever, 'I was a human Siri', *New York: Intelligencer*, 26 April 2018. Accessed on 20 December 2019.

<http://nymag.com/intelligencer/smarthome/i-was-a-human-siri-french-virtual-assistant.html>

See also Noble's contribution 'Digital Infrastructures of Race and Gender: 4. Robots, Race, and Gender' (30 January 2018) at the *Still Searching* blog hosted by Fotomuseum Winterthur.

https://www.fotomuseum.ch/en/explore/still-searching/articles/154485_robots_race_and_gender

Accessed on 20 April 2020.

For a succinct, systemic critique of digital assistants, see Miriam Sweeney. 'Digital Assistants' in C. D. Agostinho, A. Ring, N.B. Thylstrup & K. Veel (eds.), *Uncertain Archives*. (Cambridge: MIT Press, forthcoming 2020). Preprint at:

https://ir.ua.edu/bitstream/handle/123456789/6348/MSweeney_Digital%20Assistants_University%20Libraries.pdf

Accessed 30 April 2020.

⁷⁰ Tom Simonite, 'Probing the Dark Side of Google's Ad-Targeting System', *MIT Technology Review*, 6 July 2015.

Accessed on 20 December 2019.

<https://www.technologyreview.com/s/539021/probing-the-dark-side-of-googles-ad-targeting-system/>

5 ENCLOSURE



image caption 15:
 'Simple enough for a child to build: an electrical circuit generates sparks, sending bursts of radio waves across oceans and mountains'
Kino Pravda no. 23: Radio Pravda. Directed by Dziga Vertov, 1925. Archive: Österreichisches Filmmuseum. In *Dreams Rewired*.

Dziga Vertov's *Kino Pravda no. 23: Radio Pravda* of 1925, the last in a series of newsreels that documented Soviet life and provided instruction, shows amateurs constructing and operating basic radiotelegraphy equipment. Vertov valued new technologies for their power to overcome limits of time and space. He wrote extensively on the crucial role of filmmaking and the use of sound in creating an ideal society of newly conscious humans.⁷¹ Radio remained a predominantly open, bidirectional, peer-to-peer (P2P) technology into the early 20th century, maintaining a promise of empowerment and connection for all. Television too was first imagined in the P2P form of the videophone, a natural extension of the telephone. P2P is an example of a many-to-many model of connectivity, in contrast to a broadcast or server-client (one-to-many) model. Many-to-many models allow each node in a network to be both a transmitter and a receiver of data, encouraging end users to be both publishers and consumers, whereas broadcast models imply a hierarchical authority and the consumption of centrally-produced data.

In 1910, radio amateurs dominated the airwaves, with commercial and military use accounting for less than 25% of traffic. Large metropolitan areas in the US such as Boston, New York and Baltimore each had several hundred amateur stations.⁷² A major commercial application of radiotelegraphy was ship to shore communication. The radio rooms of luxury liners were designed primarily to serve wealthy passengers, with emergency communications a useful byproduct. The market was dominated by the Marconi Company, which supplied ground stations, ship-borne equipment, and radio operators; its main competitor was Telefunken. Rival companies would not carry each other's messages, except in an emergency - despite efforts at the 1906 International Radiotelegraph Convention of Berlin to mandate interconnectivity and avoid monopoly.⁷³ Regulation was minimal.



image caption 16: The ship's radio room from August Blom's *Atlantis*. The film, which depicts the sinking of the transatlantic ocean liner *SS Roland*, was based on Gerhardt Hauptmann's 1912 novel that had been published just before the *Titanic* sank. *Atlantis*. Directed by August Blom, 1913. Archive: Det Danske Filminstitut. In *Dreams Rewired*.

⁷¹ Dziga Vertov, ed. Annette Michelson, *Kino-Eye. The Writings of Dziga Vertov* (Berkeley: University of California Press, 1984).

⁷² Clinton B. DeSoto, *Two Hundred Meters and Down: The Story of Amateur Radio* (West Hartford, Conn.: The American Radio Relay League, 1936), 29.

⁷³ Michael Friedewald, 'Telefunken vs. Marconi, or the Race for Wireless Telegraphy at Sea, 1896-1914' (2012), 7-8. Available at SSRN: <https://ssrn.com/abstract=2375755>

The controversial role played by radiotelegraphy in the 1912 sinking of the *RMS Titanic* and subsequent rescue operation shored up arguments for expanding the regulation and licensing of radio. Distracted by commercial traffic, the *Titanic's* radio operator ignored a critical ice warning from another steamship in the vicinity, the *SS Californian*⁷⁴. Of the numerous responses to the distress signals transmitted by the *Titanic*, one from the *SS Frankfurt* was met with outright hostility by the *Titanic's* operator⁷⁵ - a hostility that has been attributed to an interoperability squabble, the *Frankfurt* being equipped with a Telefunken radio⁷⁶. There were credible accusations that land-based radio amateurs had disrupted vital communications - in the pre-voice era of radiotelegraphy, the combination of spark transmitters and receivers with poor selectivity inevitably caused interference⁷⁷. Further, radio amateurs were accused of misinterpreting signals and propagating misinformation⁷⁸. Legislation inevitably followed in the aftermath. New standards for maritime radio were agreed at the 1912 International Radiotelegraph Convention⁷⁹ held in London, and in the USA, the Radio Act of 1912⁸⁰ was passed, requiring radio operators to be licensed.

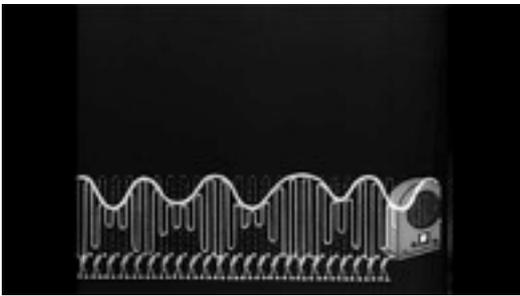


image caption 17:

The electronic valve made it possible to carry sound over continuous radio waves. In AM radio, the amplitude (volume) of a high frequency carrier wave is modulated by an audio signal - here, the thicker line. *Unsichtbare Brücken*. Director unknown, 1932. Archive: Bundesarchiv/Transit Film. In *Dreams Rewired*.

By the end of World War I, electronic valve (vacuum tube) technology had developed sufficiently to enable practical sound and music transmission, eventually leading to the broadcasting boom in the 1920s. Transmitters became both more numerous and more powerful, and interference became a problem. The 1912 Act did not deny new stations access, but as radio advertising grew, existing stations had no interest in sharing valuable airwaves with newcomers. While most countries declared the spectrum state property, in the US, the electromagnetic spectrum was (and still is) considered part of the public domain. Despite this,

⁷⁴ US Senate Report 806, 62nd Congress, 2nd session. "Titanic" Disaster: Report of the Committee on Commerce, United States Senate, Pursuant to S. Res. 283, Directing the Committee on Commerce to Investigate the Causes Leading to the Wreck of the White Star Liner "Titanic," Together with Speeches Thereon by Senator William Alden Smith of Michigan and Senator Isidor Rayner of Maryland.' p.7

<https://www.senate.gov/artandhistory/history/resources/pdf/TitanicReport.pdf>
Accessed 30 April 2020.

⁷⁵ US Senate Report 806, p.9

⁷⁶ Patrick S. Ryan. 'The ITU and the Internet's *Titanic* Moment.' *Stanford Technology Law Review* 8 (2012), p. 3.

<http://stlr.stanford.edu/pdf/ryan-theituandtheinternetstitanicmoment.pdf>
Accessed 30 April 2020.

⁷⁷ Hugh G. J. Aitken, 'Allocating the Spectrum: The Origins of Radio Regulation', *Technology and Culture* Vol. 35, No. 4 (October 1994): 692.

⁷⁸ US Senate Report 806, pp.17-19.

⁷⁹ *Radio Communication Laws of the United States and the International Radiotelegraphic Convention*. Department of Commerce, Bureau of Navigation (Washington: Government Printing Office, 1914), pp.15-48.

⁸⁰ *ibid.*, pp. 6-14.

pressure from major broadcasters and growing interference led to the restrictions on access arising with the 1927 Radio Act.⁸¹ Although the Act could not create property rights in the spectrum, its effect was to allow stations to be traded 'at prices that reflected the market value not just of their buildings and equipment but also of their frequency assignments, power levels, and authorised hours of operation.'⁸² In the ensuing decades, the explosion in demand for bandwidth from radio and TV broadcasters, cellular providers and wireless computer networks has been matched by technological advances enabling more efficient use of available spectrum, with spectrum scarcity eliminated via a de facto market mechanism. Elimination of scarcity has not, however, prevented the increasing commercialisation and consolidation of the media.⁸³

The parallels in the evolution of the Internet have been observed by Tim Wu in *The Master Switch: The Rise and Fall of Information Empires*,⁸⁴ where he characterises the history of information systems as cyclic, with open structures becoming consolidated and closed over time, possibly reopening only after disruptive innovation. Interconnectivity between radiotelegraphy companies was primarily a commercial and legal issue, and not a technical one to do with equipment interoperability; further, at least in the US, the spectrum has been seen as part of the commons, though regulation has effectively delivered it to commercial interests. Similarly, the Internet is built on shared open technical standards, but commercial and legal superstructure now threaten to create differential regimes of access. P2P and open models have again arisen with digital networks and computing, but the overwhelming tendency at the consumer device and services level is towards the proprietary, and the broadcast model. Most domestic Internet users are connected asymmetrically, achieving far greater speeds downloading than uploading data, and Internet Service Providers (ISPs) often prohibit domestic users from hosting servers and publishing their own content⁸⁵. This favouring of the downloading user-as-consumer over the uploading user-as-producer mirrors tendencies in the broader economy towards closed, 'black-box' models of technology, which also discourage - if not prohibit - creative acts.⁸⁶

⁸¹ Aitken, 'Allocating the Spectrum', 689.

⁸² Aitken, 'Allocating the Spectrum', 709.

⁸³ Lawrence Lessig. *The Future of Ideas: The Fate of the Commons in a Connected World*. (New York: Random House, 2001), p. 73ff. For a comprehensive empirical analysis, see Eli M. Noam. *Media Ownership and Concentration in America* (New York: Oxford University Press, 2009).

⁸⁴ Tim Wu, *The Master Switch: The Rise and Fall of Information Empires* (New York: Alfred A. Knopf, 2010).

⁸⁵ Comcast Corporation, a major US provider, prohibits customers of its Xfinity Internet service from connecting equipment and services including 'email, web hosting, file sharing, and proxy services and servers'.

<https://www.xfinity.com/Corporate/Customers/Policies/HighSpeedInternetAUP>

According to the Online Terms of Service of Verizon, another major provider:

'You also may not [...] use the Service to host any type of server.'

<https://www.verizon.com/about/terms-conditions/verizon-online>

Accessed 30 April 2020.

⁸⁶ Regarding the creativity that is encouraged by online platforms - the access and rewards enjoyed by 'prosumers' and 'influencers' often turns out to come at a rather high price. See for example Christian Fuchs. *Social Media: A Critical Introduction* (London: Sage, 2017).

Asymmetrical connectivity runs counter to the principle of network ('net') neutrality introduced by Wu,⁸⁷ and currently being battled over in the US.⁸⁸ Net neutrality requires that ISPs treat all traffic equally, regardless of source, destination or data type, in the interest of promoting an evolutionary model of innovation⁸⁹. In general, computer scientists, consumer interest groups and human rights activists tend to gather under a pro-net neutrality banner, arguing that tiered access schemes championed by ISPs permit a harmful concentration of power, and even commercial censorship. The consequence? – the enclosure of the Internet, in the same manner that the radio spectrum has been effectively captured from the commons. Hugh Aitken, in his study of radio regulation, reminds us that 'fears and anxieties that shaped communications policy in the past [...] were concerns about concentrated economic power, about control over the creation and movement of information, and about equal access to the means of communication by all members of society. [...] There may [...] yet persist some residue of the sentiment that the electromagnetic spectrum is a special kind of natural resource, [...] not to be treated as just another kind of real property.'⁹⁰



image caption 18: A scene in the boardroom of a television corporation: 'We've got to fight to maintain our position with any weapons we can utilise... Remember – he hasn't even protected himself with patents.' *Murder by Television*. Director unknown, 1935. Cameo Pictures. In *Dreams Rewired*.

And while political progressives uphold many-to-many models as exemplars of distributed authority and embodiments of the empowering and democratising visions of the early Internet, these models can be deployed for reactionary ends too. Consider the use of Twitter and Facebook by the ostensibly populist and anti-elitist campaigns in the UK Brexit referendum⁹¹ and the 2016 US election for the unmoderated distribution of emotionally-targeted disinformation. Hierarchical structures are essential to the construction of knowledge in science, humanities and the law. In their 2018 book *Network Propaganda*, Benkler, Faris and Roberts trace the parlous state of the US online public sphere to structural issues already existing in the broadcast radio and TV spheres. Drawing on extensive empirical studies, they describe distinct media infrastructures on the right and the left of American politics, characterising the former as more vulnerable to fake news, clickbait, and echo chamber effects, and the latter as preserving

⁸⁷ Tim Wu, 'Network Neutrality, Broadband Discrimination', *Journal of Communication and High Technology Law*, Vol. 2 (2003):141. Available at SSRN: <https://ssrn.com/abstract=388863>

⁸⁸ In June 2018, under new chairman (and Trump appointee) Ajit Pai, the US Federal Communications Commission (FCC) repealed the 2015 Open Internet Order, which had allowed the FCC to regulate ISPs in order to preserve net neutrality – a principle that it had originally adopted in 2005.

⁸⁹ Wu, 'Network Neutrality', pp. 145-147.

⁹⁰ Aitken, 'Allocating the Spectrum', 716.

⁹¹ See for example Digital, Culture, Media and Sport Committee. *Disinformation and 'fake news': Final Report* (HC 1791, 18 February 2019).

valuable editorial norms associated with traditional journalism.⁹²

⁹² 'Liberal audiences do not trust their partisan commentators at rates even approaching those that typify conservative audiences.' Yochai Benkler, Robert Faris, and Hal Roberts, *Network Propaganda. Manipulation, Disinformation, and Radicalization in American Politics* (Oxford: OUP, 2018), p.311. The authors locate the origins of this asymmetry of trust in a series of technological and institutional changes beginning in the 1970s, one effect of which was the emergence of socially and economically conservative televangelists who preached the prosperity gospel and affirmed the views of the religious right (p. 319 ff.)

6 HETERONOMY

*A screen in every home - and electric eyes spanning the globe.
But... wouldn't that mean that anyone could look into our rooms, into our lives?*⁹³

Although television had initially been imagined as a P2P videophone⁹⁴, by the time it became a practical reality in the late 1920s, it was in the form of the broadcast model⁹⁵. Pre-war audiences for broadcasts remained relatively small, however, due to restrictions in range and duration of transmissions, and the expense of receiving equipment.⁹⁶ A new wave of fiction films inflamed the public imagination with radical technologies and outrageous plots. A. Edward Sutherland's 1933 film *International House* featured a Chinese scientist's invention of a televisual 'radioscope' that could direct its eye to any remote location. In *Murder by Television* (Clifford Sanforth, 1935), an inventor who develops a way of transmitting to the entire globe is murdered in the middle of a broadcast by corporate spies who aim his powerful ray at him. *Things to Come* (William Cameron Menzies, 1936), based on the work of H. G. Wells, features massive, semitransparent public TV screens and the casual use of videophones.

The invasion of the private sphere and the consequential corrosive effects on morality were common fears of the Electric Age, and portrayed vividly in Harry Piel's 1934 movie *Die Welt ohne Maske*. It features hapless inventor Tobias Bern and his associate Harry Palmer attempting to develop a television technology to compete with that of the large electronics corporations. They unwittingly invent a device that can see through walls, giving X-ray like vision into private lives. Apart from (inevitably) facilitating voyeurism, the device reveals where a tax fraudster hides his money.⁹⁷ The power it bestows is not lost on the pair:

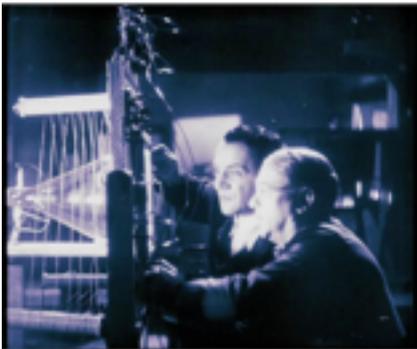


image caption 19:
'Not only can we see over distance, but we can see through everything!'
'What uncanny power we hold in our hands!'
Die Welt ohne Maske. Directed by Harry Piel, 1934. Archive: Filmmuseum Düsseldorf / Beta Film GmbH. In *Dreams Rewired*.

⁹³ *Dreams Rewired*. Luksch, Reinhart, and Tode, 2015.

⁹⁴ Media theorist Doron Galili notes that 'late nineteenth-century commentators regarded moving image transmission devices as complements to the telephone'. Doron Galili, *Seeing by Electricity: The Emergence of Television, 1878-1939* (Durham: Duke University Press, 2020), p. 23.

Videotelephony was a keystone of Robida's comprehensive vision. A. Robida. *The Twentieth Century*, p. 50ff.

⁹⁵ See in particular D. Galili, *Seeing by Electricity*, p. 108 ff. Galili argues that although the network broadcast model was 'neither a natural nor an inevitable configuration for moving image transmission media' (p. 109), early state regulation and shrewd politicking by existing media corporations institutionalised broadcast television.

⁹⁶ William Uricchio notes that in mid-1930s Germany, 'home television remained the privilege of a select group of critics and functionaries'. W. Uricchio. 'Storage, simultaneity, and the media technologies of modernity'. in J. Fullerton & J. Olsson, eds. *Allegories of Communication. Intermedial concerns from cinema to the digital*. (Rome: John Libbey, 2004), 129-130. p. 134.

And in Britain, even by late 1939, there were only about 23,000 domestic television receivers: see Edward Pawley, *BBC Engineering* (London: BBC, 1972), p.156.

⁹⁷ Florentine Strzelczyk, 'Innocent Action and Splendid Spectacle: Fascism and Entertainment in Harry Piel's Movie "Die Welt ohne Maske"', *The German Quarterly*, Vol. 77, No. 4 (Autumn 2004): 427-442.



image caption 20:
Dr. MacIntyre's X-Ray Film and X-Ray Cabinet.
 Produced by John MacIntyre, 1896. Archive: The
 National Library of Scotland.
 In *Dreams Rewired*.

While fantasies of seeing through walls continued to be imagined in the cinema well into the 1930s, authentic X-ray images had been directly incorporated into film very shortly after their discovery by Roentgen⁹⁸. Pioneering Glaswegian radiologist John MacIntyre's eponymous film of 1896 depicts a beating heart and the passage of a bismuth meal. As dramatic and transformative as these direct imaging techniques were, other abstract forms of penetrating vision – into processes rather than matter – would facilitate the analysis and administration of the body both as biological entity and as economic factor.



image captions 21A and B:
Marche Jambes Seule. Two images from a chronophotographic sequence by Etienne-Jules
 Marey, 1893. Archive: La Cinémathèque française.
 In *Dreams Rewired*.

In his researches into movement and change, the physiologist Étienne-Jules Marey invented various instruments and techniques, including a method of high-speed serial photography using very fast shutters. Marey's 'chronophotography', while often described as 'pre-cinematic', was motivated by a very different impulse to that of cinema.⁹⁹ At the movies, a rapid succession of still images is synthesised into illusory movement by exploiting persistence of vision. Chronophotography, on the other hand, is an analytic technique. The superimposition of the still images in a sequence creates a graph of a process – expanding human vision by revealing what is too quick for the eye to see, rather than tricking the eye as cinema does.

⁹⁸ W. C. Roentgen, 'On a New Kind of Rays', *Nature*, Vol. 53, No. 1369 (January 23, 1896): 274-276.
<https://doi.org/10.1038/053274b0>

⁹⁹ Stephen Mamber presents a deeper perspective on Marey beyond the superficial associations with cinema. Stephen Mamber, 'Marey, the analytic, and the digital' in J. Fullerton & J. Olsson, eds. *Allegories of Communication. Intermedial concerns from cinema to the digital*. (Rome: John Libbey, 2004), 83-91.

The chronophotograph series *Chat. Chute avec retournement* (1890) laid bare the double rotational movement that a falling cat uses to right itself in mid-air – and answered a long-standing puzzle in feline dynamics. Studies of human locomotion such as *Marche Jambes Seules* (1893) not only exposed the underlying biomechanics, but also suggested the possibility of control and enhancement. The French Army was an early client of Marey's. Chronophotographs of soldiers handling rifles suggested ways to optimise their movements – in battle, a few seconds could mean the difference between life and death, victory and defeat. Twenty years later, engineers and pioneers of ergonomics Frank and Lillian Gilbreth drew on Marey's work to develop film-based analytical techniques in their pursuit of efficiency in the workplace. By attaching small lamps to worker's hands and filming their motion, then constructing three-dimensional wire models of the captured light traces, they determined the 'value, time, and sequence of motions for producing the greatest results in the least time with the least effort and fatigue'.¹⁰⁰

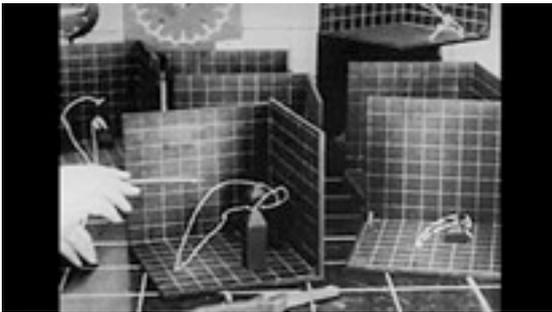


image caption 22:

'Track, record, freeze the trace. Analyse it. Then – tune, control, accelerate.'

Original Films of Frank B. Gilbreth. Produced by Frank B. Gilbreth, 1910–24. Archive: Purdue University Libraries, Karnes Archives and Special Collections.

In Dreams Rewired.

Data-driven analysis found another early, though highly specious, application in forensics. In its mission to modernise in the early 1920s, the Vienna Police Department began to collect moulds of body parts for the purposes of criminal identification, under the guidance of Austrian doctor Alphons Poller.¹⁰¹ Following a model established by criminologist Adolf Lenz, the Department embraced physiognomy as a science, incorporating a section on criminal biology in 1929 to 'examine certain designated persons [...] for the better understanding of the personality, and the more intelligent adaptation of punishment'.¹⁰² Inspired by Poller's work, the police in Alfred Deutsch's 1930 film *Die Tat des Andreas Harmer* employ a biometric dataset – here, casts of ears – to apprehend criminals.

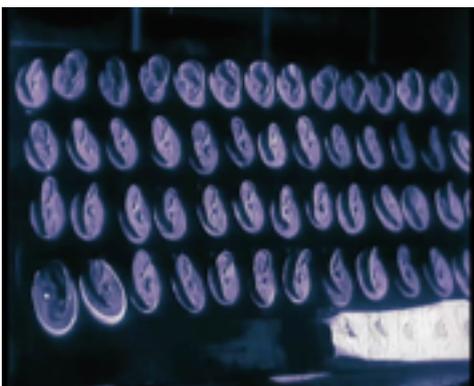


image caption 23:

'Gepollerte Ohren' ('Poller's Ears').

Die Tat des Andreas Harmer. Directed by Alfred Deutsch, 1930. Archive: Filmarchiv Austria.

In Dreams Rewired.

¹⁰⁰ Frank Bunker Gilbreth, *Bricklaying System* (New York: M. C. Clark, 1909), 312.

It should be noted that the Gilbreths' approach emphasised worker welfare and introduced ergonomic considerations, unlike the more instrumental approach of Taylorism.

¹⁰¹ W. Gleispach, 'Twenty-Five Years of Criminology in Austria', *Journal of Law and Criminology*, Vol. 24, Issue 1 (Summer 1933): 188-189.

¹⁰² Gleispach, 'Twenty-Five Years of Criminology', 189.

The development of ubiquitous, networked sensing and computing, together with advances in algorithm design, have revolutionised the potential of data beyond optimisation, ushering in an age of 'predictive analytics'. Through statistical inference and machine learning, algorithmic decision making (ADM) systems deliver predictions about how someone might behave, what they might buy, when they might die. Contemporary predictive policing models use police departmental data on crimes recorded – which are, importantly, distinct from crimes committed – to apportion policing resources by neighbourhood. In their investigations into racial bias in predictive policing models, William Isaac and Kristian Lum observe that 'if a police department has a history of over-policing some communities [...], predictive policing will merely reproduce these patterns in subsequent predictions.'¹⁰³ As ADM becomes increasingly widely deployed, controlling access to education, employment, finance, and healthcare, so too increase the risks presented by the amplification of historical bias, or errors in conceptualising and specifying objectives.¹⁰⁴

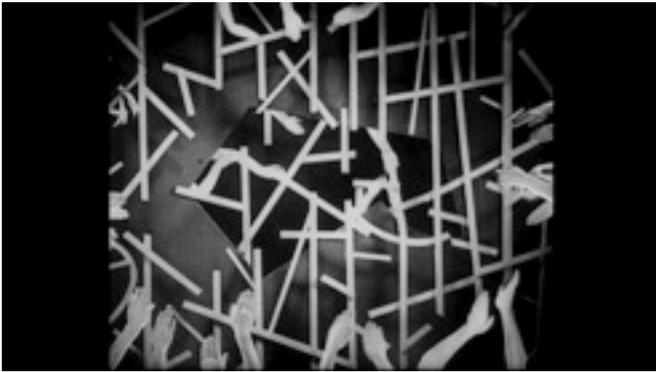


image caption 24: *Hände: Das Leben und die Liebe eines zärtlichen Geschlechts*. Directed by Miklós Bándy & Stella Simon 1927-28. Archive: Filmarchiv Austria. In *Dreams Rewired*.

*'We can engineer the context around a particular behaviour and force change that way [...] We are learning how to write the music, and then we let the music make them dance.'*¹⁰⁵

Uncanny power today belongs to the agents of what Shoshana Zuboff has termed 'surveillance capitalism' – the specific contemporary mode of economic activity in which network intelligence corporations, in the guise of information and service providers and media platforms,¹⁰⁶ trade financial instruments derived from predictive analytics in a 'behavioural futures market'.¹⁰⁷ Underwriting this rampant gambling on human behaviour is an even more malignant trend – in

¹⁰³ William Isaac & Kristian Lum, 'Setting the Record Straight on Predictive Policing and Race', *In Justice Today*, 3 January 2018. Accessed on 20 December 2019. <https://medium.com/in-justice-today/setting-the-record-straight-on-predictive-policing-and-race-fe588b457ca2>

¹⁰⁴ Cathy O'Neill discusses how an algorithmic system perpetuated discriminatory admissions procedures at a medical school, among numerous other examples, in Cathy O'Neill, *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (London: Penguin, 2016), 115–118.

¹⁰⁵ Unidentified software developer quoted in Zuboff, *The Age of Surveillance Capitalism*, 295.

¹⁰⁶ The current (2020), picturesque abbreviation for the most powerful of these is G-MAFIA BAT (Google, Microsoft, Amazon, Facebook, IBM, Apple almost everywhere, and Baidu, Alibaba, Tencent in China).

¹⁰⁷ Zuboff, *The Age of Surveillance Capitalism*, 96.

behavioural 'nudging'.¹⁰⁸ Informed by neuroscientific research on perception and cognition, and fed by data harvested from smartphone apps via highly asymmetric and opaque terms of service, the agile vendor of products and services effectively manages user desire and actions. Prediction is much less hazardous when a user, confronted with an explicit and limited set of options, feels that she is choosing freely. And seemingly insignificant changes in the framing of options may lead to dramatically different behaviour.¹⁰⁹ The consequence is a grave and urgent threat to the dignity of human persons compelled into an outlandishly heteronomous future. It is no small irony that the technological wonders of the Electric Age were originally sold to the public as vehicles of autonomy.

¹⁰⁸ For a presentation of nudging as a benign, indeed essential component of user interface design, see C. Schneider, M. Weinmann, & J. vom Brocke. 'Digital Nudging: Guiding Online User Choices through Interface Design'. *Communications of the ACM* (2018) 61: pp. 67-73. 10.1145/3213765.

For a contrasting view that regards nudging as an example of a 'dark pattern', see: <https://www.darkpatterns.org/types-of-dark-pattern> Accessed 28 April 2020.

¹⁰⁹ The classic exploration is by Daniel Kahneman and Amos Tversky, 'The Framing of Decisions and the Psychology of Choice', *Science*, vol. 211, no. 4481 (January 1981): 453-58.