



The contradictions of digital modernity

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Abstract

This paper explores the concept of digital modernity, the extension of narratives of modernity with the special affordances of digital networked technology. Digital modernity produces a new narrative which can be taken in many ways: to be descriptive of reality; a teleological account of an inexorable process; or a normative account of an ideal sociotechnical state. However, it is understood that narratives of digital modernity help shape reality via commercial and political decision-makers, and examples are given from the politics and society of the United Kingdom. The paper argues that digital modernity has two dimensions, of progression through time and progression through space, and these two dimensions can be in contradiction. Contradictions can also be found between ideas of digital modernity and modernity itself, and also between digital modernity and some of the basic pre-modern concepts that underlie the whole technology industry. Therefore, digital modernity may not be a sustainable goal for technology development.

Keywords Digital modernity · Modernisation · Disruption · Innovation · Data

1 Introduction

Modernity and the associated process of modernisation serve descriptive, teleological and normative purposes. Greater uptake of technology, and other developments such as the general movement of peoples from rural to urban areas, the replacement of ad hoc responses to events with management using abstract systems, and the wide adoption of international aspects of culture, can be summarised in the simple statement that a place is modernising. Teleologically, modernisation is often experienced as a natural, unstoppable process that unfolds inexorably [Giddens (1990) uses the image of the juggernaut] while viewed normatively, 'modernisation' is the sort of process that governments, companies and even individuals work to make happen. In this paper, I wish to focus on the effects of digital technology on modernisation as a narrative, a discourse through which reality is shaped and modelled, and modernity as the subjectively experienced outcome of the processes that go to make up modernisation. The truth or falsity of the modernisation

narrative, and its digital extension, is less to the point than that people and organisations subscribe to it. As the Thomas theorem has it: "if men define situations as real, they are real in their consequences" (Merton 1995). This paper should be understood as reporting the modernisation narrative, rather than endorsing it, although as a narrative through which reality is shaped, there are many agents and forces working to bring it about.

Giddens (1990) argues that modernisation has three consequences. First, time and place become separated and local variation dissolves. Time becomes a universal, measured remotely by standard clocks, while places are opened up to wider influences via media, migration, communications and transport. Second, as a result of these openings, social action and attitudes become 'disembedded' from local contexts, and can increasingly be described and understood without reference to the local. Third, in the midst of this flux, individuals are capable of self-criticism and adaptation based on examination of their context—reflexivity—which undermines any pretence of linearity and creates complex feedback loops of influence and action (Beck et al. 1994). This third consequence means that advances of knowledge, particularly scientific knowledge, do not automatically yield control of our environment, as thinkers of the enlightenment and the scientific positivists imagined would happen.

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Modernity as a concept has moved in and out of fashion through time, and its meanings are not particularly stable. Furthermore, the very notion of ‘modernity’ is under threat from its own success—the fluidity it has ushered in has made it harder to draw a firm boundary around ‘modern’ places and practices (Koenis 2014), while many critics from Lyotard (1984) onwards have declared it superseded by post-modernity. However, the association between modernity and technology is a constant aspect, and the World Wide Web has a particularly strong connection, facilitating as it does globalisation, abstract and expert systems, undermining traditional practices and hierarchies, and disembedding. Furthermore the language of modernisation has driven many developments in Silicon Valley and the technology industry, where the implementation of modern ideas, processes and technologies is often seen as an unalloyed good (Fukuyama [2006] writes that “the desire to live in a modern—that is, technologically advanced and prosperous—society” is “universal”). Governments the world over have also signed up to these ideas, working to implement digital government, and where possible courting major figures from the technology industry. Trust in progress is less unquestioning now than before the wars and environmental degradation of the twentieth century, but the strand of progress for which digital technology is responsible has been spared the most trenchant criticism. Alan Turing, for example, is regarded with an uncritical admiration that we do not find with, say, Oppenheimer.

The spread of digital technology is (an important) part of the modernisation narrative, which will be the subject of this paper; the critique from postmodernism is clearly important and influential, but space precludes discussion of it here (see Sect. 4 for some hints about how this argument might go). The narrative of modernisation is hard to resist (even if people wished to resist it), and this has helped the spread of digital networks in many areas of life through persuasion rather than force. Many have represented these developments as leading to new states, or discontinuities in human history (Kurzweil 2005, Brynjolfsson and McAfee 2014; Barrat 2015; Schwab 2016), in which the technology itself will actively reshape the lives of people and the futures of nations and businesses (Schmidt and Cohen 2013). Digital modernity is therefore perceived and presented as a much more singular and revolutionary state than modernity in general. When the technology is digital, the potential for accelerating and turbo-charging the transformative processes of modernity is argued to be exponentially greater.

In this paper, I want to challenge this type of narrative. I do not want to argue that it is not happening—as with most large-scale narratives about the progress or otherwise of humankind, it makes sense of many observable developments, while neglecting many others. I wish to challenge its normative aspect, in two ways. First, I will argue that

the uncritical acceptance of digital modernity as a good is unwise. Second, more importantly, I will argue that there are important contradictions in the modernity narrative. In Sect. 2, I will discuss two different types of digital modernity, based on time and space, respectively. Then in Sect. 3, I will outline some of their internal contradictions, and some of the external contradictions with other important aspects of technology adoption.

2 Two dimensions of digital modernity

Modernity is a relative term—a society or culture is more modern than something else, which could be another society or an earlier stage of the same society (a) where tradition and geography are stronger influences than rationalism and abstraction, (b) which are exclusive rather than inclusive, and (c) where social structures are constraining, imposed hierarchies as opposed to contractual, transactional networks. The contrast can be therefore in space or time (or both), which indicates that modernity in general, and digital modernity in particular, can be mapped on those two dimensions (Koenis 2014).

In the temporal dimension, the important contrast is between backward societies and advanced ones. These two types of society are placed on a single dimension, implying that—if the backward society ceases to stubbornly reject progress—it will eventually evolve to become advanced. Advanced societies have the characteristics of modernity, while in the backward ones one expects, for example, disputes to be solved by violence, people to stick pins in voodoo dolls, and governments to be imposed, rather than being chosen by citizens. It is also possible for advanced societies to, as the revealing saying goes, slip back into barbarism, following some failure of technology, natural calamity, social unrest or rejection of advanced political wisdom.

In the spatial case, the contrast is between being at the centre of things, where value is created, and being peripheral (Shils 1975). At the periphery we find rural areas, so-called edgelands and liminal spaces, and the developing world. These contrast with major cities, hubs, centres of excellence, clusters of creativity and industry where innovation happens (Formica 2017). Again, these are not incommensurable; political rhetoric places them on a single dimension, so that a peripheral place could become more modern with development, a central place can lose its position through decline, and may regain it through regeneration schemes.

So, in its own terms, the narrative of modernity rests on three key assumptions. First of all, progress is linear, and indeed reversible, so it is possible to make judgments such as ‘this culture is more advanced than that’, ‘this city is more modern than that village’, and (when postulating a reversal away from modernity) ‘this nation has become

more barbarous'. Secondly, it assumes (on pain of circularity) that 'backward', 'advanced', 'peripheral' and 'central' can be characterised independently of terms such as 'more modern' or 'less modern'. Thirdly, it assumes that progress in one dimension will more or less correlate with progress in another. Each of these assumptions can be questioned, although in this paper I will scrutinise the third most deeply; the first and second assumptions tend to support each other, and historical and geographical studies of modernity can help break the circularity of definition (e.g., Berman 2010). However, as noted above, my main aim in this paper is to examine the supplementary narrative of digital modernity and evaluate its internal consistency. What, then, is digital modernity?

Digital modernity in many ways extends these two dimensions, increasing the distance between the modern and the backward/peripheral. The narratives of digital modernity are important drivers of political and business projects, and so help create their own reality, still resting on the three assumptions. In the remainder of this section, we explore the digital modernity narratives more deeply, before we consider some of their problems in Sect. 3.

2.1 The temporal dimension

An important and often-noted effect of digital technology is to compress time (Harvey 1990), as increasingly many events or actions can take place within a given interval. Automation of response means that entire processes involving the complex interaction of several agents can be carried out in a barely-perceptible interval. Even processes that necessarily include humans in the loop can be disintermediated to focus on the efficiency of the basic input–output. A romance, which in the nineteenth century could be spun out to cover several hundred pages of a novel, can now be short-circuited from discovery to consummation into an evening using a dating app such as Tinder (Sumter et al. 2017). The game of roulette used to involve an elaborate set of rituals in a casino which had the effect of slowing down the game and making it into a social event (stimulating the imaginations of authors such as Dostoyevsky, George Eliot and Ian Fleming). It has now been transformed by fixed-odds betting terminals into an addictive, solitary pastime promoting heavy, unreflective gambling, and allowing many more bets in a given time, vastly increasing the likelihood of the house beating the individual (Adams and Wiles 2017).

It is the nature of digital technology to disintermediate and disrupt existing processes (Curley and Salmelin 2018, pp. 15–25), and this is where technologists look to create innovation (Christensen et al. 2015; Yang et al. 2016). The ability of the advanced society to innovate at will is one of the things that distinguish it from the backward one, and a highly advanced society would be expected to innovate

routinely. Since innovation, in this narrative, is disruptive, the super-advanced society will be super-disruptive, a world of startups where disruption is routine, and where institutions and entrepreneurs would be expected to adapt constantly to new pressures; Schumpeter's (1950) world of creative destruction will have come to the fore. As an example, Britain's Engineering and Physical Sciences Research Council, a funding body (which partially funded this research), states in its delivery plan that the first of its five ambitions is to "introduce the next generation of innovative and disruptive technologies", apparently without stopping to consider whether this is good or bad.¹

Taken to the extreme, this is a world in which to be advanced is to be a disruptor, and therefore it follows immediately that to exist is to be backward. Once a system is implemented, or a product produced, it is ripe for disruption from radical innovators (Colombo et al. 2015). The classic cases are Airbnb (Guttentag 2015) and Uber (Cramer and Krueger 2016; Yang et al. 2016), each of which has not only disrupted an industry (of tourist accommodation and taxis respectively), but also challenged regulatory systems across the globe. They are already the targets of new disruptive technologies (Langner 2016; Greene 2017).

The temporal aspect of digital modernity appeals in the political world, where disruption foregrounds the contingency of established ways of doing things, and provides a story about how an active politician is achieving measurable successes. Political disruption, facilitated by technology, can itself facilitate the introduction of new practices that existing institutions are unable to support (Dikeç 2017), and the coalescing of new (mass) groups (Margetts et al. 2016). In the UK, for example, on the right, the disruptive potential for free markets has often been highlighted, by intellectuals such as Hayek, and politicians such as Thatcher. Liz Truss, a Conservative cabinet minister at the time of writing, recently argued, for instance, that free enterprise supported by technology:

... is intensely democratic and open—breaking down monopolies, hierarchies and outdated practices. It's why so many people from non-establishment backgrounds have succeeded in enterprise. You do not have to be part of the Old Boys Network to set up a business. The essence of entrepreneurship is what the author Malcolm Gladwell has called the freedom to be 'disagreeable': to not rely on the approval of others or give up in the face of some initial social uproar. It's how all the big disruptors made their mark—from Apple to Ikea (Truss 2018).

¹ <https://www.epsrc.ac.uk/about/plans/deliveryplan/prosperityoutcomes/productivity/>.

Voices on the left also like disruption (perhaps of different things) with technology: Labour Prime Minister Harold Wilson lauded the white heat of the technological revolution in the 1960s (Byrne 2016), while Tony Blair was described by his own spin doctor as “a lovely man, but he is so relentlessly modernising I feel myself getting more traditional by the day” (Campbell 2010, p. 71). Radical commentator and activist Paul Mason both describes and advocates what he calls networked revolution made possible by technology (Mason 2013), and a key factor in the position of Labour’s far left leader (at the time of writing), Jeremy Corbyn, is Momentum, a grassroots movement organised via social media (Pickard 2018).

Note that digital modernity does not automatically appeal to radical movements (even ones that wish to disrupt), if they do not endorse the narrative of (digital) modernisation. For example, the German Greens do not use technology very much for their internal processes, and are currently engaged in a careful consultative process to determine how far they should, and how they should structure technologically mediated systems so that they remain consistent with their egalitarian and inclusive philosophy (Thuermer et al. 2016).

2.2 The spatial dimension

The spatial dimension brings us to the shrinkage of space in modernity (Harvey 1990), as modernisation marginalises the periphery and privileges the centre. An innovation cluster is tightly-packed, and indeed we have seen in recent years how an idea such as automated trading in financial centres demands clustering because the distance from the server to the market makes a difference to how efficiently it can take advantage of arbitrage opportunities (Urstadt 2009). Within a hub, acquaintance is not rationed by geography, and so we can develop many more links with others, creating richer networks. Connections are not accidental or imposed, as in the sparsely-populated periphery, where one does not choose one’s neighbours. In the centre, connections are rational and transactional—they are win-wins for each side. The occupant of a modern space is valuable to many others, and expects value in return.

Once more, we can extend the logic to produce digital modernity. On the spatial dimension this produces the idea of *cyberspace*. In one of the earliest (science fiction) uses of the term, we already get a sense of cyberspace as a compression of space via quantification to produce greater intelligence.

Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts. ... A graphic representation of data abstracted from the banks of every computer in the human sys-

tem. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding ... (Gibson 1984, p. 69).

A common usage today refers to the Web and its various extensions (Heylighen 1994).

Rational connection becomes increasingly possible, because data is searchable and we can find the connections we want, rather than be presented with those that are available. Hence cyberspace affords opportunities for order and rationality, in accordance with Isaiah Berlin’s description of the eighteenth century philosopher Condorcet’s modernist ideal:

The rational reorganisation of society would put an end to spiritual and intellectual confusion, the reign of prejudice and superstition, blind obedience to unexamined dogmas, and the stupidities and cruelties of the oppressive regimes which such intellectual darkness bred and promoted. All that was wanted was the identification of the principal human needs, and the discovery of the means of satisfying them. (Berlin 1992, p. 5).

In the spatial dimension of digital modernity, the best that hapless reality can achieve is to get closer to the perfection of the algorithm and the data.

Cyberspace is populated by avatars, digital doubles or digitally extended selves, made up of increasingly rich data (Parkinson et al. 2017). Records of our transactions and communications abound, and with the advent of the quantified self movement, even measures of our own well-being can be added to the mix. In the quantified self, the individual is rendered transparent to him- or herself, thereby allowing advantage to be taken of digital feedback to self-optimize (or biohack). The optimisation of the self is carried out only in terms of the data—the data are optimised as a proxy for the self. The quantified self movement positions self-tracking sensors as interfaces for improving technological engagement, and our lives become as a result more data-driven (Ruckenstein and Pantzar 2017).

Smart cities are pitched as a necessary and unavoidable response to the technical, material, social, and organisational problems associated with modernism’s push toward urban growth, to improve quality of life and provide a competitive and sustainable city (Shapiro 2006; Schaffers et al. 2011; Batty et al. 2012). Again, smart cities are technologically rooted, depending on low power miniature sensors, high-speed wireless communication networks and high-performance computing. The smart city is awash with citizen-aware intelligent environments and user-centric services, such as smart homes and smart buildings, smart energy, smart mobility, smart parking, and smart health and well-being, which between them will improve

efficiency, lower resource consumption and promote quality of life for citizens. The city achieves an online presence, and the transformation of the citizen into avatar is perfected. Policy depends now on the state of the person's data, not of the flesh and blood human. The Internet of Things will accelerate these trends further (Zanella et al. 2014).

Governments too can get excited about the possibilities of these data avatars. We can be studied, diagnosed and perfected, in an implementation of what Oakeshott (1975) called the therapeutic state. To avoid (the appearance of) coercion, a covert paternalistic philosophy has grown up called *nudging* (Thaler and Sunstein 2008), which is particularly effective in the data world—since the data furnishes the means of assessing whether citizens' performance, choices or well-being are acceptable, as well as the means for providing feedback. Technology amplifies the effect of the nudge, because it is networked, pervasive and dynamically updated (Yeung 2017). Modernising governments, such as that of David Cameron in the UK, have invested resources in the development of units for implementing policy based on the nudge philosophy (Halpern 2015).

Digital government, and the use of AI in government, are assumed to produce better decisions (Eggers et al. 2017); it also, of course, implicitly suggests that a government in possession of the data is in a better position to make decisions about societies rather than, say, the people directly involved, who are unlikely to have the same access to comprehensive data and inferential power. For example, in the UK, a recent report assembled a great deal of data to pronounce that “Some recent surveys have uncovered levels of loneliness across all ages that are worryingly high. What we do not yet know is if this is a sign of a growing problem, or because efforts to break down the stigma of loneliness are working, making people more willing to acknowledge their loneliness. Whichever it is, there is much to do.” Despite this somewhat equivocal statement, the report went on to demand that the national government lead a “UK wide Strategy for Loneliness across all ages” (Jo Cox Commission on Loneliness 2017)—and a minister was indeed appointed in January 2018.

The profusion of data means that the individual is measurable, and via feedback, perfectible. Governments are naturally interested, but in the cyberspace of digital modernity, imperfection is also to a large extent policed by the digital citizenry itself (Goldman 2015; Ronson 2015; Laidlaw 2017; Kasra 2017). One can be shamed for being physically imperfect, socially awkward, intellectually lacking, racist, sexist, abusive to animals or morally dubious. One can shame fat people and fat-shamers with equal facility. In the narrative of digital modernity, we can hope and aim for a population that maximises health and well-being, respectful behaviour, and

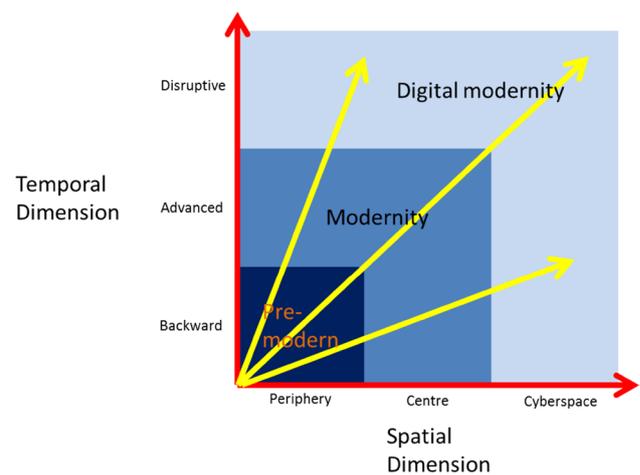


Fig. 1 Trajectories through the two dimensions of digital modernity

rational and prudential choices, even if some of the debate is occasionally rough (Rohlfing and Sonnenberg 2016).

Hence if we view digital modernity from its spatial dimension, we can see the possibility of not only the rational reconstruction of society, as the pre-digital modernists wanted, but also the means of discovery and satisfaction of human needs, wants and desires, all from the new sources of data.

3 Inherent tensions in the model

Digital modernity can thus be conceptualised as a two-dimensional space, with a temporal axis running from backward societies to advanced societies to societies of disruptive innovation, and a spatial axis running from the periphery to the centre to the smart space of intelligence and data. This narrative, descriptive and normative, makes it hard to resist modernisation, and associated processes such as rationalisation, technologisation, datafication, bureaucratisation, globalisation, urbanisation, democratisation, emancipation, and individualisation. Who would advocate living in a backward society on the periphery?

The ‘map’ of this two-dimensional space looks like Fig. 1. The narrative of progress toward digital modernity implies societies moving from the bottom left to the top right. Many technologies serve this vision, both proving disruptive of existing systems and helping bring about an ordered and smart society. One example is the blockchain, whose cryptographically secured distributed ledgers are intended to disrupt the positions of trusted middlemen in transactions, thereby reducing costs to other parties. As a result, it could become the chosen system of record for all transactions, both between and within organisations. Certainly disruptive then, but also it could become the

foundation of a rational, open, secure means of identification and record to enable a dramatic rationalisation of administration, bureaucracy and work (Iansiti and Lakhani 2017). AI might be another example, which on the one hand threatens to disrupt all manner of current methods of work (and other areas, such as warfare) because of its abilities to model, predict and anticipate human behaviour, so bringing with it worries about the unemployment and unrest it might cause (Ford 2013), and on the other promises far greater understanding of human society and interaction, especially as it begins to converge with cognitive psychology and neuroscience (Gershman et al. 2015).

However, there are some tensions within this simple narrative of digital modernity, which I will explore in this section. Firstly (Sect. 3.1), the characteristic state of digital modernity is different in each dimension. Certainly in many cases, as noted above, disruptive technologies and smart use of data will help us converge on the goal, as expressed by Berlin, of identifying and meeting basic human needs. However, it may be that we advance towards digital modernity by something other than a neat 45° line—we might instead become more disruptive, or alternatively simply collect and process more (and richer) data, which correspond to the two other progress lines in Fig. 1. Might there be different results with those two emphases?

Secondly (Sect. 3.2), digital modernity is presented as an extension of, and improvement of, ‘core’ modernity. How far can that supposition be supported?

And thirdly (Sect. 3.3), digital modernity to some extent rests on the bedrock of our pre-modern relationships (including very basic attitudes and instincts that may even be hard-wired). Might digital modernity undercut some of these instincts, and therefore its own foundations?

3.1 Between the dimensions

Firstly, it should be noted that the temporal dimension and the spatial dimension set out different sets of priorities, and that the steady accumulation and processing of data can itself be disrupted from many perspectives. On the other hand, incumbent master-controllers of data, especially large ones, try to identify and snap up potential disruptors and challengers (e.g., Facebook’s purchases of WhatsApp, Oculus and tbh, and Google/Alphabet’s of Waze, DeepMind and Softcard), to defend and expand their positions. If they are able, they will resist disruption using the oligopoly powers they have by virtue of their size and commercial heft. Mark Zuckerberg promises to address the problems of incumbency by accepting the logic of disruption, and co-opting the disruptors, in this somewhat disingenuous post.

A lot of us got into technology because we believe it can be a decentralizing force that puts more power in

people’s hands. (The first four words of Facebook’s mission have always been “give people the power”.) Back in the 1990s and 2000s, most people believed technology would be a decentralizing force.

But today, many people have lost faith in that promise. With the rise of a small number of big tech companies—and governments using technology to watch their citizens—many people now believe technology only centralizes power rather than decentralizes it.

There are important counter-trends to this—like encryption and cryptocurrency—that take power from centralized systems and put it back into people’s hands. But they come with the risk of being harder to control. I’m interested to go deeper and study the positive and negative aspects of these technologies, and how best to use them in our services.²

Indeed, the extent of the ambition of many so-called ‘disruptors’ goes no further than to be bought out for millions, and the incumbents can argue in many cases that they will add value as a result of those buy-outs (Desyllas and Hughes 2009; Buenstorf 2016). The power of data will be a regulator, not a liberator of creative destruction and innovation (Hacking 1990; Yeung 2017). In particular, the major platforms defend their role as the means of providing visibility and legitimacy to other actors, creating a set of dependencies that it is hard to disrupt (Kenney and Zysman 2016; Gillespie 2017). On the other hand, when startups and innovators attempt to disrupt the major platforms, they often do this by providing services that do not rely on keeping data; cf. for example the indinet,³ MaidSafe (Lomas 2016), Blockstack and others (Keane 2017).

Ultimately, there is simply a tension between the role of disruptor and the role of coordinator. The so-called platform economy, in which Uber and Airbnb are usually included, is a mix of big data, clever algorithms and the cloud to allow new marketplaces to emerge, matching buyers and sellers; these platforms can become very large, because of network effects combined with monopolization of the data they gather from their operation (Kenney and Zysman 2016). The questions of who gains from these developments, who is prevented from competing (either by technology or by regulation), and how, if at all, existing institutions and individuals are protected from negative effects, are usually political questions up for grabs (and lobbying).

This tension is a version of the wider clash between politics and governance. The temporal dimension of digital modernity encourages conflict and an agonistic approach

² <https://www.facebook.com/zuck/posts/10104380170714571?pnref=story>.

³ <https://ind.ie/>.

to debate and argument, where consensus is there to be challenged (and potentially strengthened by the challenge). Meanwhile, on the spatial dimension, the focus is on rationally ordered and coordinated existence (as Zuckerberg points out,⁴ the decentralised systems are harder to control). The disruptors envisage a world in which people make and defend their own choices, however way out, while the coordinators imagine ways to use data to show people the most efficient route to the pursuit of their best interests. These two visions sometimes merge, but will surely conflict on occasion.

The control-through-data paradigm of governments and the large technology incumbents is unattractive (Zuboff 2015). On the other hand, disrupting it can be worrying too. Hacking, though sometimes performed in the public interest, is a standing problem for the Web, whose design assumed a relatively small and homogeneous good-faith community of users. Even those whose hacking is for positive reasons may not contribute to the public good (Powell 2016)—the disruptors may fail to produce a more rational, or indeed more citizen-centric or public-oriented cyberspace. Fake news is undermining the hopes for the Web as a beacon of Enlightenment. The Dark Web remains a place to which disruptive (and criminal) behaviour can migrate, out of the reach of mainstream technological surveillance and control. Rather like the slums and informal communities that are required to support planned cities like Brasilia and Chandigarh (Scott 1999), much of the innovation around markets might take place in the low-trust, high-risk margins of the Dark Web (Bartlett 2014).

Finally, it was noted earlier that cyberspace was self-policing. However, it can notoriously be disrupted by trolling and other activities, which are often, if not exclusively, intended to entertain an audience with some rough humour at the expense of the trolled person (Dyner 2016). Adolescents appear to be especially vulnerable to this sort of attention, while still finding it hard to refuse access to their online selves (Weinstein and Selman 2016). Women and non-white people are common targets of trolling and abuse when defending their rights (Jakubowicz 2017; Lewis et al. 2017). Scions of digital modernity are divided as to whether these problems can be sorted out technically (Geiger 2016), or whether we should retreat into a positive, but actually rather exclusive, big data paradigm where the individual, his or her agents and social machines, benevolent companies and the state get to use the technology (Mayer-Schönberger and Cukier 2013). There is a general hope that when digital modernity reaches its apogee, the abusive trolls and misogynists will be expelled back into the periphery (the

backwoods where they belong), although this is countered by doubts about whether such people can be identified easily, as well as by the problem that youthful indiscretions will remain to be judged, so that people may not be given the benefit of doubt in the future about poor behaviour in the past (Mayer-Schönberger 2009; Ronson 2015).

3.2 Between core modernity and digital modernity

Modernity, as conceived by Giddens (1990), is complex and resistant to control, principally because of the phenomenon of reflexivity. As people reflect on their position in society, the insights of scientific knowledge, data science and other such modes of inference and discovery feed back into their own understanding of their behaviour, which makes prediction harder (if not impossible), as they factor these predictions and judgments into their thinking and work around them. As a response to this, Vass (2013) argued that the notion of reflexivity needed to be decomposed, to encompass ideas of ‘responsivity’ and ‘recognition’—responsivity referring to the quality of reaction of the environment to actions by individuals, and recognition referring to the ways in which the digital environment supports individuals’ maintenance of their social position, allowing its use as a resource by the individual or others. Vass and Munson (2015) discuss reflexivity of social machines in the context of a 2×2 matrix of high/low responsivity crossed with high/low recognition.

Yet while digital modernity may indeed render reflexivity more complex, and at least sometimes less valuable to the individual, it may also reduce the space for reflexivity to operate—and, to the extent that reflexivity can undermine attempts to predict and control, it may facilitate the control of individuals by governments, organisations or others with access to the data and inferential capacity.

We might expect this to happen differently in our two dimensions. Temporally, if the cycle of innovation and disruption gets ever faster, then it will become impossible for any reflexive monitoring to take place in a timely fashion. However, responsive the digital environment is to the actions of individuals, if it is persistently and rapidly evolving thanks to disruptive innovation, then individuals simply would not be able to come to understand the responses. Signals from the environment, through constant change, will not be legible to them (Scott 1998). Similarly, the recognition that an individual receives from a system will depend, presumably, on the individual’s relations to and status within the institutions that are being disrupted. Recognition requires reflection of the past in, or influence of the past on, the present. Yet the past is precisely what the temporal brand of digital modernity tries to escape from.

With regard to the spatial dimension, Hildebrandt (2015) argues that a system that takes one’s first order preferences for granted, catering for them before one is aware of them,

⁴ <https://www.facebook.com/zuck/posts/10104380170714571?pnref=story>.

diminishes the capacity to reflect on habits and desires, and therefore the capacity to remake oneself and improve as a person (by one's own standards). Data for profiling and pre-emption is much more easily available for the owners of the databases and software than the individual data subject, and this is crucial because the data will produce non-obvious knowledge about matters such as creditworthiness, health and employability, creating asymmetry. The actual affordances of technology matter, but may be hidden (in several different ways—[Burrell 2016]). In such a world legal expertise is displaced by data expertise, which is an issue because, unlike lawyers who are paid to advise clients who are fully aware of their involvement in a legal case, data scientists are generally funded by the data consumers, thereby exacerbating the asymmetry. Furthermore, important social protections—such as the socialisation of risk via insurance—may disappear, to be replaced by individual responsibility, as data can enable the risks associated with individuals to be priced to them directly.

It is not clear that Hildebrandt's suggestion (2015, pp. 222–224) that counter-profiling the profilers will help redress the balance. Quite apart from complex issues such as data gathering and presentation back to individuals, the problem in the cases discussed above is less reciprocity (our awareness of our interlocutors' purposes and beliefs about us), than the (non-relational) lack of a space in which to understand ourselves and reflect. The asymmetry between what I know about me and what Google knows about me may be a problem in my relationship with Google, but the important issue for me is really my lack of knowledge of myself. I could know so much more, and don't. How can I make authentic choices in such circumstances?

Yet the existence of this knowledge impales us on the horns of a dilemma. As Hildebrandt argues, transparency following the collection and analysis of personal data about oneself “can be an infringement of privacy, because one is forced to confront knowledge about oneself that disrupts the future” (Hildebrandt 2015, p. 74). The very of the knowledge forces one to choose between knowing or not knowing, for example, the sex of one's baby, the risks associated with one's genome, or the likelihood that one will be the victim (or the perpetrator) of a crime.

In pre-modern societies, the sense of self was “sustained largely through the stability of the social positions of individuals in the community. Where tradition lapses ... lifestyle choice prevails” (Giddens 2002, p. 47). On this reading, core modernity retained alternative resources to support the self. However, digital modernity threatens to undermine these resources too; the disruption characteristic of the temporal dimension undoes social stability, while data and machine learning problematises lifestyle choice.

3.3 Between digital modernity and its social foundations

Digital modernity depends on a number of technologies, institutions and practices; our technologies presuppose various social and sociotechnical systems. Without them, their foundations might become less resilient. Hence, to the extent that the practices of digital modernity undermine long-existing practices and assumptions, risk is inherent.

There are a number of reasons to think that this is another contradictory aspect of digital modernity. The metaphors of digital modernity are entrancingly ethereal—cyberspace, the cloud, virtual reality, the World Wide Web, frictionless information. And yet we still have to access this unearthly realm with real physical devices, whether PCs, smartphones or futuristic implants in the brain. Designers need to come together with engineers, managers and marketers to develop networks of users with sufficient scale to provide the benefits of communication and sharing information.

These affordances are built on centuries of social regularity, regulation and practice—the rule of law, respect for contract, limited liability, bankruptcy law. They also require materials, including rare earths, compounds of lithium for batteries for portability, and copper wires to carry information and electricity. The cloud itself is a network of data warehouses, which generates about the same amount of humanity's carbon emissions as the airline industry.

Giant infrastructure projects, such as power grids and communications networks, demand big initial investments whose return would not be realised for years, if not decades, requiring capital and agencies to absorb the risk of default. The organisations needed to work for long periods of time toward a single goal will require good governance, and so we need auditors enter the picture. Investments of such longevity will need stability and as little uncertainty as practicable—so we need security and cybersecurity firms, insurance, and global policing, intelligence and anti-terrorism agencies.

Yet many see digital modernity as a means of unpicking this skein of institutions. Barlow's *Declaration of the Independence of Cyberspace* suggested that “Your legal concepts of property, expression, identity, movement, and context do not apply to us. They are all based on matter, and there is no matter here”.⁵ In more recent years, commentators have continued to emphasise the Internet's disruptive potential over its dependence on the things it might disrupt. McChesney (2014) argues that it “is central to the movement to build a more democratic society and extend self-government to the economy”. Capitalism “will be abolished by creating something more dynamic that exists, at first, almost unseen within

⁵ <https://www.eff.org/cyberspace-independence>.

the old system, but which will break through, reshaping the economy around new values and behaviours” (Mason 2013).

Yet this kind of disruption is only possible because of advances in IT and the institutions upon which the industry rests. As Mason (2013) argues, “The thing that is corroding capitalism is information”. The risk is that digital modernity will disrupt its own foundations in business, science and industry. Disembedding is characteristic of modernity, but there may be limits built into it; for instance, much of modern economics is an attempt to disembed and reify markets, but markets function most effectively when they retain their immersion in other social institutions and relations (Polanyi 1944).

The potential for disruption and rationalisation could also undermine more focused institutions and practices. Consider the example of smart contracts, programs that use the blockchain to execute contractual arrangements automatically. This is a major reinterpretation of what a contract is there to do. Contracts are not mechanisms to make things happen. They are social arrangements, voluntary constraints neither unlike (Fried 2015) nor identical to (Shiffrin 2007; Barnett 2012) promises, backed by the machinery of law. They have a social function, to enable cooperation, and help spread habits of warranted trusting around an economy. Many alternative types of agreement receive support from rich networks of norms (of friendship or kinship for instance), whereas parties in contracts often have very little in common other than the contract. Hence the trust-building function is key to the social value of the institution.

Contract has built into it the presumption that interpretation and flexibility will be needed, partly to deal with failures to agree on the meanings of particular commitments, partly because of the immense complexity of some contracts, for example governing major pieces of infrastructure, partly because some contracts are unfair, and partly because things change and both parties may want and expect the contractual terms to evolve over time. Contracts are also rarely in one direction; they generally involve reciprocity or exchange, and help manage the additional complexity that brings.

There is no way back from the smart contract (other than a hard fork, impractical as a general remedy for obvious reasons) if parties have misunderstood the specification of the code, if the code is badly-written, or if one party has been coerced or misled into taking on an unfair obligation. Contracts are means to navigate a complex landscape, to promote productive cooperation and trust in a world where the parties involved may only have weak ties with each other. The aim of blockchain technology is to remove the need for trusted third parties, and so, far from replacing contracts, smart contracts in the wrong places are likely to disrupt or inhibit vital social relationships (Christopher 2017; O’Hara 2017). That is not to say that they have no role to play, for example, in contexts where trust is antecedently low in supply

or within large, complex organisations where shared goals and ontologies can be assumed. But outside these friendly environments, the smart contract rests upon ideas of trust, promise and reciprocity that its own anti-trust agenda would undermine.

4 Discussion

In Plato’s *Republic*, Socrates is asked to construct a plan of a just state, which he does, describing its frugal way of life. But Glaucon, one of his interlocutors, replies “It seems that you make your people feast without any delicacies. ... If they aren’t to suffer hardship, they should recline on proper couches, dine at a table, and have the delicacies and desserts that people have nowadays” (Plato 1997, p. 1011). Socrates replies that:

It isn’t merely the origin of a city that we’re considering, it seems; but the origin of a luxurious city. And that may not be a bad idea, for by examining it, we might very well see how justice and injustice grow up in cities. Yet the true city, in my opinion, is the one we’ve described, the healthy one, as it were. But let’s study a city with a fever, if that’s what you want. There’s nothing to stop us. The things I mentioned earlier and the way of life I described won’t satisfy some people, it seems, but couches, tables and other furniture will have to be added, and of course, all sorts of delicacies, perfumed oils, incense, prostitutes, and pastries. We mustn’t provide them only with the necessities we mentioned at first, such as horses, clothes, and shoes, but painting and embroidery must be begun, and gold, ivory, and the like acquired. Isn’t that so? (Plato 1997, pp. 1011–1012).

To get all these desirable things, the new state will need to defend its land and go to war, and so need an army and arms. It will need agricultural surpluses, and decision-making methods that will scale to a larger population. It will need doctors, women’s dresses, animals to eat, musicians, actors, servants. In other words, Socrates tells Glaucon, if you want to preserve the luxuries which we now possess, as well as the justice which you crave, you will need to adapt the system while ensuring it remains capable of supporting all the industries and activities we do not want to give up.

This is Glaucon’s dilemma. If we innovate by disrupting the system, we risk losing its current benefits. Digital modernity cannot simply sweep away the remains of the pre-modern and modern worlds, because they contain not only much of value in themselves, but also the foundations of digital modernity itself. Hence uncritical pursuit of digital modernity could undermine its own preconditions. This is not, of course, an unusual position for a technology to find itself in—for example, uncritical

pursuit of intermittent renewable energy sources such as solar and wind could undermine the more reliable fossil energy grid, resulting in blackouts that would discredit renewables. It is also conversely true that many of the most productive innovators in this space, the Pages, Brins, Zuckerbergs and Bezoses, are innovative because of their single minded focus on creating the conditions for digital modernity. However, the same does not necessarily apply to policymakers, administrators, lawmakers, ideological entrepreneurs and representatives of civil society, who must shape the conditions in which technology is socially constructed.

Digital modernity is a narrative that can be descriptive, teleological or normative. By influencing policymakers and leading technology innovators, it becomes a self-fulfilling prophecy by shaping the reality it purports to describe. As a narrative, it may even have rescued modernity from the critique of postmodernism, although this is beyond the scope of this paper, which focuses on its internal contradictions. But it is suggestive that the report that launched postmodernism as a key concept in social science (Lyotard 1979/1984) takes as its starting point the effects of technology, especially artificial intelligence, databases and the knowledge economy, on twentieth century modernity, while other commentators too see technology as a key factor (e.g., Anderson 1998). Combined with the possibility that Lyotard in particular may have misrepresented developments in a field with which he was somewhat unfamiliar (cf. Anderson 1998, pp. 24–27), it is at least possible that there are continuities between postmodernism and digital modernity, and that the longer perspective afforded us in the twenty-first century may support an argument that postmodernism was premature in writing off modernity, and that the phenomena that the postmodernists had spotted were signs merely that modernity was morphing into a new form courtesy of digital technology. Evaluating this argument is a matter for future work.

Digital technology is clearly transformative, and promises to improve many aspects of humanity's material condition; indeed, its benefits may also be political, social and environmental, as well as economic. All the more reason, then, that we should be aware of digital modernity's internal contradictions, and its external conflicts with other ways of understanding the world.

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References

- Adams PJ, Wiles J (2017) Gambling machine annexes as enabling spaces for addictive engagement. *Health Place* 43:1–7
- Anderson P (1998) *The origins of postmodernity*. Verso, London
- Barnett RE (2012) Contract is not promise: contract is consent. *Suffolk Univ Law Rev* 45(3):647
- Bartlett J (2014) *The dark net: inside the digital underworld*. William Heinemann, London
- Barrat J (2015) *Our final invention: artificial intelligence and the end of the human era*. Thomas Dunne Books, New York
- Batty M, Axhausen KW, Giannotti F, Pozdnoukhov A, Bazzani A, Wachowicz M, Ouzounis G, Portugali Y (2012) Smart cities of the future. *Eur Phys J Special Topics* 214(1):481–518
- Beck U, Giddens A, Lash S (1994) *Reflexive modernization: politics, tradition and aesthetics in the modern social order*. Polity Press, Cambridge
- Berlin I (1992) *The crooked timber of humanity: chapters in the history of ideas*. Vintage, New York
- Berman M (2010) *All that is solid melts into air: the experience of modernity, new edn*. Verso, Cambridge
- Brynjolfsson E, McAfee A (2014) *The second machine age: work, progress and prosperity in a time of brilliant technologies*. W.W. Norton, New York
- Buenstorf G (2016) Schumpeterian incumbents and industry evolution. *J Evolut Econ* 26(4):823–836
- Burrell J (2016) How the machine “thinks”: understanding opacity in machine learning algorithms. *Big Data Soc*. <https://doi.org/10.1177/2053951715622512>
- Byrne L (2016) Wilson's white heat. *Fabian Review*. <http://www.fabians.org.uk/wilsons-white-heat/>. Accessed 24 Apr 2018
- Campbell A (2010) *The Alistair Campbell diaries volume one: prelude to power 1994–1997*. Hutchinson, London
- Christensen CM, Raynor ME, McDonald R (2015) What is disruptive innovation? *Harvard Business Review*. <https://hbr.org/2015/12/what-is-disruptive-innovation>. Accessed 24 Apr 2018
- Christopher CM (2017) The bridging model: exploring the roles of trust and enforcement in banking, Bitcoin and the blockchain. *Nevada Law J* 17(1):139–180
- Colombo M, Franzoni C, Veugelers R (2015) Going radical: producing and transferring disruptive innovation. *J Technol Transfer* 40(4):663–669
- Cramer J, Krueger AB (2016) Disruptive change in the taxi business: the case of Uber. *Am Econ Rev* 106(5):177–182
- Curley M, Salmelin B (2018) *Open innovation 2.0: the new mode of digital innovation for prosperity and sustainability*. Springer, Cham
- Desyllas P, Hughes A (2009) The revealed preferences of high technology acquirers: an analysis of the innovation characteristics of their targets. *Camb J Econ* 33(6):1089–1111
- Dikeç M (2017) Disruptive politics. *Urban Stud* 54(1):49–54
- Dynel M (2016) “Trolling is not stupid”: internet trolling as the art of deception serving entertainment. *Intercult Prag* 13(3):353–382
- Eggers WD, Sschatsky D, Viechnicki P (2017) *AI augmented government: using cognitive technologies to redesign public sector work*. Deloitte University Press. <https://www2.deloitte.com/insights/us/en/focus/cognitive-technologies/artificial-intelligence-government.html>. Accessed 24 Apr 2018
- Ford M (2013) Could artificial intelligence create an employment crisis?. *Commun ACM* 56(7):37–39. <https://doi.org/10.1145/2483852.2483865>
- Formica P (ed) (2017) *Entrepreneurial renaissance: cities striving towards an era of rebirth and revival*. Springer, Cham
- Fried C (2015) *Contract as promise: a theory of contractual obligation, 2nd edn*. Oxford University Press, Oxford

- Fukuyama F (2006) After neoconservatism. *New York Times*. <http://www.nytimes.com/2006/02/19/magazine/after-neoconservatism.html>. Accessed 24 Apr 2018
- Geiger RS (2016) Bot-based collective blocklists in Twitter: the counterpublic moderation of harassment in a networked public space. *Inf Commun Soc* 19(6):787–803
- Gershman SJ, Horvitz EJ, Tenenbaum JB (2015) ‘Computational rationality: a converging paradigm for intelligence in brains, minds and machines’. *Science* 349(6245):273–278. <https://doi.org/10.1126/science.aac6076>
- Gibson W (1984) *Neuromancer*. Ace Books, New York
- Giddens A (1990) *The consequences of modernity*. Polity Press, Cambridge
- Giddens A (2002) *Runaway world: how globalisation is reshaping our lives*, 2nd edn. Profile Books, London
- Gillespie T (2017) Algorithmically recognizable: Santorum’s Google problem and Google’s Santorum problem. *Inf Commun Soc* 20(1):63–80
- Goldman LM (2015) Trending now: the use of social media websites in public shaming punishments. *Am Crim Law Rev* 52:415–51
- Greene T (2017) Winding Tree is the new kid on the blockchain set on disrupting Airbnb and Expedia. *The next web*. <https://thextweb.com/money/2017/09/08/1075124/>. Accessed 24 Apr 2018
- Guttentag D (2015) Airbnb: disruptive innovation and the rise of an informal tourism accommodation sector. *Curr Issues Tour* 18(12):1192–1217
- Hacking I (1990) *The taming of chance*. Cambridge University Press, Cambridge
- Halpern D (2015) *Inside the nude unit*. W.H. Allen, London
- Harvey D (1990) *The condition of postmodernity: an enquiry into the origins of social change*. Blackwell, Oxford
- Heylighen F (1994) Cyberspace. In: Heylighen F, Joslyn C, Turchin V (eds) *Principia cybernetica web*. Principia Cybernetica, Brussels. <http://pespmc1.vub.ac.be/CYBSPACE.html>. Accessed 24 Apr 2018
- Hildebrandt M (2015) *Smart technologies and the end(s) of law*. Edward Elgar, Cheltenham
- Iansiti M, Lakhani KR (2017) The truth about blockchain, Harvard Business Review. <https://hbr.org/2017/01/the-truth-about-blockchain>. Accessed 24 Apr 2018
- Jakubowicz A (2017) Alt_Right white lite: trolling, hate speech and cyber racism on social media. *Cosmop Civil Soc* 9(3):41–60
- Jo Cox Commission on Loneliness (2017) *Combatting loneliness one conversation at a time: a call to action*. <https://www.ageuk.org.uk/our-impact/campaigning/jo-cox-commission/>. Accessed 24 Apr 2018
- Kasra M (2017) Vigilantism, public shaming and social media hegemony: the role of digital-networked images in humiliation and socio-political control. *Commun Rev* 20(3):172–188
- Keane J (2017) ‘Blockstack today: 5 apps already being built on the decentralized Web’, Coindesk. <https://www.coindesk.com/building-blockstack-five-firms-show-us-just-platform-capable/>. Accessed 24 Apr 2018
- Kenney M, Zysman J (2016) The rise of the platform economy. *Issues Sci Technol Spring* 32:61–69
- Koenis S (2014) *Voices of the people: pluralism in Dutch Politics (1994–2014)*. VU University Press, Amsterdam
- Kurzweil R (2005) *The singularity is near*. Viking Penguin, New York
- Lyotard J-F (1984) *The postmodern condition: a report on knowledge*. Manchester University Press, Manchester
- Laidlaw EB (2017) Online shaming and the right to privacy. *Laws*. <https://doi.org/10.3390/laws6010003>
- Langner C (2016) Uber, disrupted, Bloomberg. <https://www.bloomberg.com/gadfly/articles/2016-04-15/uber-disrupted>. Accessed 24 Apr 2018
- Lewis R, Rowe M, Wiper C (2017) Online abuse of feminists as an emerging form of violence against women and girls. *Br J Criminol* 57(6):1462–1481
- Lomas N (2016) After a decade of R&D, MaidSafe’s decentralized network opens for alpha testing’, *TechCrunch*. <https://techcrunch.com/2016/08/12/after-a-decade-of-rd-maidsafes-decentralized-network-opens-for-alpha-testing/>. Accessed 24 Apr 2018
- Margetts H, John P, Hale S, Yasseri T (2016) *Political turbulence: how social media shape collective action*. Princeton University Press, Princeton
- Mason P (2013) *Why it’s still kicking off everywhere*. Verso, London
- Mayer-Schönberger V (2009) *Delete: the virtue of forgetting in the digital age*. Princeton University Press, Princeton
- Mayer-Schönberger V, Cukier K (2013) *Big data: the essential guide to work, life and learning in the age of insight*. John Murray, London
- McChesney RW (2014) *Digital disconnect: how capitalism is turning the internet against democracy*. New Press, New York
- Merton RK (1995) The Thomas Theorem and the Matthew Effect. *Soc Forces* 74(2):379–424
- O’Hara K (2017) Smart contracts—dumb idea. *IEEE Internet Comput* 21(2):97–101
- Oakeshott M (1975) *On human conduct*. Clarendon Press, Oxford
- Parkinson B, Millard DE, O’Hara K, Giordano R (2017) The digitally extended self: a lexicological analysis of personal data. *J Inf Sci*. <https://doi.org/10.1177/0165551517706233>
- Pickard S (2018) Momentum and the movementist “Corbynistas”: young people regenerating the Labour Party in Britain. In: Pickard S, Bessant J (eds) *Young people re-generating politics in times of crises*. Palgrave Macmillan, Cham, pp 115–137
- Plato (1997) *Republic*. In: Cooper JM (ed) *Plato: complete works*. Hackett Publishing Company, Indianapolis, pp 971–1223
- Polanyi K (1944) *The great transformation: the political and economic origins of our time*. Farrar & Rinehart, New York
- Powell A (2016) Hacking in the public interest: authority, legitimacy, means and ends. *New Media Soc* 18(4):600–616
- Rohlfing S, Sonnenberg S (2016) “Who is really British anyway?” A thematic analysis of responses to online hate materials. *Cyberpsychology*. <https://doi.org/10.5817/CP2016-4-2>
- Ronson J (2015) *So you’ve been publicly shamed*. Pan Macmillan, London
- Ruckenstein M, Pantzar M (2017) Beyond the quantified self: thematic exploration of a dataistic paradigm. *New Media Soc* 19(3):401–418
- Schaffers H, Komninos N, Pallot M, Trousse B, Nilsson M, Oliveira A (2011) Smart cities and the future Internet: towards cooperation frameworks for open innovation. In: Domingue J, Galis A, Gavros A, Zahariadis T, Lambert D, Cleary F, Daras P, Krco S, Müller H, Li M-S, Schaffers H, Lotz V, Alvarez F, Stiller B, Karnouskos S, Avessta S, Nilsson M (eds) *The future internet: future internet assembly 2011: achievement and technological promises*. Springer, Berlin, pp 431–446
- Schmidt E, Cohen J (2013) *The new digital age: reshaping the future of people, nations and business*. Random House, New York
- Schumpeter J (1950) *Capitalism, socialism and democracy*, 3rd edn. Harper & Row, New York
- Schwab K (2016) *The fourth industrial revolution*. World Economic Forum, Geneva
- Scott JC (1998) *Seeing like a state: how certain schemes to improve the human condition have failed*. Yale University Press, New Haven
- Scott JC (1999) Geographies of trust, geographies of hierarchy. In: Warren ME (ed) *Democracy and trust*. Cambridge University Press, Cambridge, pp 273–289
- Shapiro JM (2006) Smart cities: quality of life, productivity and the growth effects of human capital. *Rev Econ Stat* 88(2):324–335

- Shiffrin SV (2007) The divergence of contract and promise. *Harvard Law Rev* 210:708–753
- Shils E (1975) *Center and periphery: essays in macrosociology*. University of Chicago Press, Chicago
- Sumter SR, Vandenbosch L, Ligtenberg L (2017) Love me Tinder: untangling emerging adults' motivations for using the dating application Tinder. *Telematics Inform* 34(1):67–78
- Thaler RH, Sunstein CR (2008) *Nudge: improving decisions about health, wealth and happiness*. Yale University Press, New Haven
- Thuermer G, Roth S, Luczak-Roesch M, O'Hara K (2016) Internet use, in- and exclusion in decision-making processes within political parties. *Proc 8th ACM Conf Web Sci NY ACM*. <https://doi.org/10.1145/2908131.2908149>
- Truss L (2018) The conservative case for disruption', *CapX*. <https://capx.co/the-conservative-case-for-disruption/>. Accessed 24 Apr 2018
- Urstadt B (2009) Trading shares in milliseconds. M.I.T. technology review. <https://www.technologyreview.com/s/416805/trading-shares-in-milliseconds/>. Accessed 24 Apr 2018
- Vass J (2013) Webscience, “social machines” and principles for re-designing theories of agency: a prolegomenon. *Web Science 2013 Workshop: harnessing the power of social theory for web science*. <https://eprints.soton.ac.uk/359190/>. Accessed 24 Apr 2018
- Vass J, Munson J (2015) Revisiting the three Rs of social machines: reflexivity, recognition and responsivity. *Proc 24th Int Conf World Wide Web NY ACM*. <https://doi.org/10.1145/2740908.2743974>
- Weinstein EC, Selman RL (2016) Digital stress: adolescents' personal accounts. *New Media Soc* 18(3):391–409
- Yang Y, Han W, Shaw M (2016) A framework for disruptive innovation diffusion, in proceedings of adoption and diffusion of information technology (SIGADIT). <http://aisel.aisnet.org/amcis2016/Adoption/Presentations/4/>. Accessed 24 Apr 2018
- Yeung K (2017) “Hypernudge”: big data as a mode of regulation by design. *Inf Commun Soc* 20(1):118–136
- Zanella A, Bui N, Castellani A, Vangelista L, Zorzi M (2014) Internet of things for smart cities. *IEEE Internet Things* 1(1):22–32
- Zuboff S (2015) Big other: surveillance capitalism and the prospects of an information civilization. *J Inf Technol* 30(1):75–89