From Automation to Autonomy: Technological Sovereignty for Better Data Care in Smart Cities

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Abstract Automation through smart city technology deployments and big data analytics has the potential to create more liveable, sustainable, and equitable cities. However, internationally, there are many examples of smart city developments that have attracted criticism, concerns, and community backlash over issues such as data ethics, privacy, mass surveillance, commodification, and social control. In response, this chapter presents DataCare—a model for cities to practically implement technological sovereignty as a way to renew and maintain the social licence to operate smart city technology. Grounded in a critical review of the literature, the chapter argues that data collection and automation in smart cities must be more citizen and community-oriented. Informed by smart city developments in Toronto and Barcelona, the chapter introduces DataCare—a model for a dedicated facility hosted by the city and offered to citizens, communities, and businesses. The envisaged DataCare space can be tailored to raise awareness of data ethics, to run data literacy training seminars, to engage in participatory data analytics, and to speculate about city data futures. DataCare aims to increase data transparency and autonomy, showcase new business opportunities, and empower citizens and community.

Keywords Smart cities · Privacy · Data science · Urban informatics · Urban science · Data governance · Technological sovereignty · Data sovereignty
1 Introduction

In mid-January 2020 the New York Times revealed how a small, secretive company developed and marketed a controversial facial recognition app to more than 600 law enforcement agencies in the United States—from local police in Florida to federal agencies such as the FBI and the Department of Homeland Security (Hill 2020). Without people’s knowledge or consent, Clearview AI scraped and deposited over three billion photos from social networks, employment sites, and educational sites, among others (Naughton 2020) into a database for its artificial intelligence (AI) powered facial recognition algorithm. The app enabled users to upload a photo, which the algorithm would then read and analyse. It would reveal the photographed person’s identity by delivering matching images, together with links to where they appear.

The rise in smart city surveillance technologies—for example smart lamp posts with CCTV infrastructure such as in Darwin, Australia (Carlson et al. 2020; O’Malley and Smith 2019)—enables law enforcement to run facial recognition algorithms against police and government databases. Clearview AI’s unique selling proposition—and appeal to police—is the size of its database. The company claims to possess 3 billion images, as opposed to the tens or hundreds of millions held by US authorities, rendering a presumed identification more likely. Recent journalistic investigations show that Clearview AI is used by the Australian police without public accountability (Goldenfein 2020). The smart-city-enabled racial profiling in Darwin could soon be exacerbated by the use of Clearview AI’s capabilities by local police.

Cases such as this one might make the public particularly uneasy. Who does not have a name-associated picture somewhere on the internet these days? To some, it may be disturbing to imagine their photo could be harvested without knowledge, consent, or an adequate mechanism to revoke access or request deletion. In the case of Clearview AI, to have data removed from its database, one must “submit [a] name, a headshot and a photo of a government-issued ID to facilitate the processing of [the] request” (O’Flaherty 2020, para. 5). This uneasiness relates to what Leszczyński (2015) terms anxieties of control—a phenomenon where individuals are more concerned with transparency regarding which data is collected, as well as having control over flows of personal spatial information, rather than its potential uses. People’s lack of concern about potential data (mis)use might be explained by their limited understanding of the potential negative personal consequences of data (mis)use, combined with a lack of knowledge of the vast capabilities of big data technology and automation to convert seemingly irrelevant bits of information into deep insights about themselves and others. However, the dangers of mass-surveillance are well documented by scholars navigating this growing knowledge asymmetry (Andrejevic and Gates 2014; Brayne 2017; Galdon-Clavell 2013; van Zoonen 2016; West 2019; Zuboff 2019). The Clearview AI case marks the acceleration of a concerning global trend towards mass surveillance by private companies offering their surveillance technologies to public agencies whilst bypassing the awareness of and consent from data subjects.
It is no coincidence that cities are often at the forefront of mass surveillance initiatives. Ubiquitous computing, mobile devices, big data and automation combine to give rise to a new urban paradigm, which is celebrated by many technology corporations and local governments alike: the smart city. Yet the current hype around smart cities often tends to be technocratic and lacks criticality (Kitchin 2014). The smart city creates a mediated world that is increasingly governed, judged and served back to us by computer code, algorithms, automated systems, robotics, and data. This new data-driven, automated era offers many challenges and opportunities, some which we explore in this chapter. The rapid adoption of smart city software and infrastructure facilitates the collection, distribution, storage and processing of vast amounts of data about everyday human lives. Urban spaces provide the greatest accumulation of data subjects who can be ‘mined’ for data, from both their private devices and sensors and cameras in the urban environment.

Irrespective of whether smart city automation and urban technology innovation take on the cloak of delivering better productivity, liveability, and sustainability, whether it is led by states or corporations (or in partnership), self-proclaimed smart cities, algorithms and data are everywhere, setting precedents for digital authoritarianism or surveillance capitalism. For individuals, the complexity of such systems makes it impossible to fully understand or control them, which jeopardises individual autonomy and privacy. At the society-level, the inadequacy of current regulatory frameworks and institutions to protect and enforce data privacy and ethics bears the risks of dystopian and democracy-eroding consequences. However, cases of cities are emerging that have implemented urban technology in a citizen-focused manner with a view to maintain the city’s civic sovereignty, as well as maintaining community ownership and control over data and technology infrastructure. This approach to smart cities for the people is often referred to by the notion of ‘technological sovereignty’ (Couture and Toupin 2019; Lynch 2019), which we will discuss in more detail in Sect. 3.

Against this backdrop, this chapter aims to sensitise readers to some of the issues, challenges and concerns that the Automated City poses—not just from automation but also related forms of technological disruption such as algorithmic analysis of big data, machine learning, artificial intelligence, and their urban applications. To ground our argument, we first review some critical literature on the implications of smart city data and automation (Sect. 2). We then briefly introduce and discuss two cases of smart city technology initiatives: The Sidewalk Labs’ Toronto Waterfront development and the Barcelona smart city project (Sect. 3). Contrasting and juxtaposing these two empirical but opposing cases help us to illustrate the theoretical notion of technological sovereignty in a practical context. Further building our argument for the significance and merit of technological sovereignty as a way forward, we then introduce ‘DataCare’ in Sect. 4. Rather than opposing automation and technological development altogether, we agree that urban data in the digital age has the potential to make our cities more liveable, sustainable, and equitable. However, this potential can only be realised if underpinned by good data practices (Daly et al. 2019) and the rebalancing of power and informational asymmetries. In response, we developed
DataCare as a model to increase data transparency and access, showcase new business opportunities, and empower citizens. As a cornerstone in the Automated City, the DataCare model suggests new ways for cities to champion data ethics, social justice and the value of the civic sphere. In Sect. 5, we conclude with an outlook summarising some of the initiatives and components that aim to empower citizens in the smart city and are relevant in making the DataCare vision a reality.

2 Automating Oppression?

The techno-utopian smart city sits at the confluence of data-driven urbanism and automation. Both the collection of data in urban areas (Kitchin 2017), as well as mechanisation and automation (Hitomi 1994) have centuries-old histories. However, their fusion under the smart city umbrella is a relatively recent phenomenon, with in situ implementations having hardly transcended the confines of controlled, dedicated environments (Macrorie et al. 2019) such as build-from-scratch smart cities (see Angelidou 2017; Cugurullo 2018), urban innovation and living labs (c.f. Cardullo et al. 2018), or dedicated innovation districts (see Cosgrave et al. 2013; Katz and Wagner 2014).

This integration between data and automation holds the dangerous potential to bypass public deliberation and sidestep accountability in the pursuit of harmful and inequitable agendas disguised in benevolence. Before developing this holistic critique, we provide brief accounts of the evolution and implications of urban data collection and automation, respectively.

2.1 Urban Data Collection

As Kitchin (2017, p. 44) notes, there is a “rich history of data being generated about cities concerning their form, their citizens, the activities that take place, and their connections with other locales.” Already in classical antiquity, rights to and membership in a political unit implied relinquishing privacy through some level of data provision. In order to tax the inhabitants of their vast empire, the Romans devised an effective mechanism to collect census data by sending representatives to all corners of their provinces directly to the data source, rather than bringing all data subjects to the capital. These representatives would later carry these results to Rome, where they were centrally gathered and processed. Today, what is referred to as the Roman census method forms the backbone of big data architecture (Inmon and Linstedt 2014, p. 50), with ubiquitous IoT-enabled data gathering and transfer, and centralised cloud-based aggregation, processing and interpretation.

John Snow’s work of mapping the London Cholera Epidemic of 1854 is argued to represent “the earliest harbinger of the Big Data movement” (Peled 2013, p. 11), not due to the size of the data set, but as a result embodying the distinct rationale of big
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data—to identify otherwise undiscoverable or unexpected correlations. In mapping the cholera deaths against public water pumps, Snow was able to make visible the correlation between Cholera and water, thus countering contemporary beliefs that Cholera spread through ‘foul air.’

These two examples are not merely precursors of big data, but illustrate the ongoing tensions resulting from the purpose for which such data are generated and applied: the consolidation of power on the one hand, and safeguarding the population and upholding the public good, on the other.

While state surveillance remains a pertinent and concerning form of power consolidation, the dotcom boom gave rise to private-led surveillance capitalism as a new frontier of using big data to monitor, predict and control public behaviour through incentives and punishments so as to maximise consumption and profits (Zuboff 2015, 2019). Beyond identifying general trends, a key trait of big data is its ability for particularisation—to produce a fine-grained understanding of individuals, which can then be used to devise the best-suited form of behavioural prompting (Wigan and Clarke 2013). Termed data capitalism by West (2019), the process of data commodification enables those actors with the necessary resources and expertise to extract and use information to accumulate power by hiding behind narratives of social and political benefits claimed to derive from networked technologies. Surveillance capitalism and data capitalism work in tandem.

Directing our view far back into human history also raises awareness of the extent to which the data-landscape and the pace of data gathering and processing have expanded and accelerated. Kitchin (2017) argues that while past efforts were bound by the constraints of time, space and the scope of a particular domain, today urban data collection is “continuous, exhaustive to a system, fine-grained, relational and flexible across a range of domains” (Kitchin 2017, p. 46). This ubiquity and continuity is vital to accomplish big data’s raison d’être: to stumble upon unanticipated correlations from enormous amounts of data collected at the level of individual units—human or non-human. Until such a correlation is established, the value of a particular dataset is contingent, resulting in uncritical, preemptive and wide rather than thoughtful, purposeful and targeted data gathering.

Following the logics of data capitalism, any data may become highly profitable when combined with other, vaster data at some undefined point in the future. This openness makes data privacy and autonomy inherently undesirable for the corporations that would have to accept substantial losses of revenue and competitive advantage. Data subjects cannot be asked for informed consent when those collecting the data cannot (or do not wish to) articulate how, when and for what purpose that data will be used, as it is in their best interest to keep their options open (Peled 2013). In recent years, there has been a growing interest in concepts such as autonomy-by-design and privacy-by-design (Cavoukian 2012; Rubinstein 2011), with attempts to embed them in, e.g. Europe’s GDPR legislation. However, as Rubinstein and Good (2013) demonstrate through detailed evaluations of technology platforms such as Facebook and Google, the obstacle to privacy-by-design does not lie in the inability to practically materialise the concept in software design. Instead, it is a result of the
inherent contradictions between the business interests of profit and power consolidation (c.f. West 2019; Zuboff 2015), and the privacy-by-design objectives of targeted collection of strictly necessary data for a well-defined purpose and timeframe, which would undermine those very interests.

2.2 Robotic Systems and Automation

Similar to data collection, automation has been an integral part of human history since we began developing tools as *homo faber* (Hitomi 1994), embracing the idea that through them we can control and shape our future and environment (c.f. Alvares 1976, p. 35). The adoption of advanced automation first took hold in the manufacturing and more generally the business sector. However, with the proliferation of managerialism in urban governance (Forrest and Wissink 2017; Harvey 1989) and the rise of the corporate and neoliberal smart city (Hollands 2014; Pali and Schuilenburg 2019; Sadowski 2020), the disempowering effects of automation are beginning to spill over into cities. Smart cities are a continuation of using tools—science and technology—as a mechanism to predict, control and shape urban environments.

Hitomi (1994) pinpoints mechanisation as part of the Industrial Revolution, and the fusion of electronics and mechanisation after World War II as two key acceleration points towards automation. He defines mechanisation as human labour being replaced by machines while humans maintain control over the machines themselves. Automation “also replaces this control action by machines; that is, ‘automation’ means the replacement of both human physical and mental activities by machines” (Hitomi 1994, p. 122). Later, the wave of digitisation that began in the 1980s laid the foundation for today’s explosion of the *Fourth Industrial Revolution* spanning a plethora of networked, sensing and ‘intelligent’ technologies that blur the boundaries between the physical and digital world (Macrorie et al. 2019). The Korean u-City (ubiquitous city) seeks seamless integration, where “ubiquitous computing infuses computers into the real world and renders the distinction between the virtual and real world meaningless” (Hwang 2009, p. 368).

As is the case with data collection, mechanisation and automation exist within the duality between the consolidation of power, and technological evolution for economic growth, and therefore, according to prevailing economic theory, human prosperity (c.f. Galor and Tsiddon 1997 for a discussion of the latter). Recurring phases of worker resistance in response to their deskilling and removal from production decisions stand as a historic testimony of worker disempowerment and their shrinking bargaining power on the labour market in favour of capitalist factory owners and managers.

One key form of automation entails the automatic regulation of the machine’s behaviour through feedback (Veillette 1959 cited by Hitomi 1994). Today, insights based on big data are increasingly becoming significantly enhanced, frequent and fine-grained feedback for automated smart city systems and decision-making. As Macrorie et al. (2019) point out, the temptation is high to treat such applications
as distant future scenarios. However, they note that, in reality, these applications already are pervasive in numerous facets of life, from transport management, to health provision, security and new forms of surveillance.

IBM’s smart city technology served Rio de Janeiro authorities to repress public protest by socio-economically disadvantaged people against their displacement caused by the 2014 FIFA World Cup (Gaffney and Robertson 2018; Rekow 2015). Chinese mass-surveillance technology not only reinforces government ideology (Hatton 2015) and enables racial profiling of minorities (Mozur 2019) but is now sold globally in Ecuador, Zimbabwe, Uzbekistan, Pakistan, Kenya, the United Arab Emirates, and Germany and others (Mozur et al. 2019). China’s progress in AI has allowed for the monitoring of communication on networked platforms towards digital, networked authoritarianism, defying the original values of the internet’s founders as inherently democratising (Burgers and Robinson 2016).

Beacons of Western democracy follow suit. In late January 2020, London police announced the introduction of real-time facial recognition technology taking advantage of the city’s vast network of CCTV cameras to automatically detect matches and notify of suspects (Satariano 2020). At the same time, the UK’s National Anti-Terrorism Policing Network lists (and under public pressure retracts) non-violent activist groups such as Animal Aid, Palestine Solidarity Campaign, Greenpeace or Extinction Rebellion as terrorist groups along with violent neo-nazi groups in official counter-terrorism policing documents (Dodd and Grierson 2020). While public pressure and democratic control reversed these controversial law enforcement guidelines, they provide a dystopian taste of what could be enforced remotely with great force through autonomous technology that exceeds human capabilities in “precision, strength, dependability, speed and endurance” (Macrorie et al. 2019, p. 7) if public scrutiny ever stops or is deliberately quenched—with limited physical risks to the perpetrators of such authoritarianism.

Macrorie et al. (2019) further point out that robotics and automated systems not only receive (sensorial) feedback and make decisions, but through their physicality can act immediately upon these decisions and intervene in the real world without delay. In doing so, automated systems in cities replicate the exclusion of the public and limit the civic sovereignty of democratically accountable entities such as local governments from key decisions that directly affect them, and thus reduce the dependency on (and opportunity for social justice reliant on) human judgement altogether.

2.3 Smart Cities as the Fusion of Data and Automation

Mass-data collection and automation raise serious concerns each on its own. Combined and without proper ethical, legal and regulatory frameworks, or adequate technological and data literacy at both individual and organisational level, smart cities concentrate and simultaneously obfuscate power. This power often rests in the
hands of state agencies, technology corporations or both as the ties between the two sectors further consolidate through public-private partnerships.

Through the compression of time between data collection, interpretation, decision-making and intervention, as well as (false) claims to objectivity and neutrality (Kitchin 2015b; Peled 2013), fully automated data-driven systems bypass and undermine the need for public deliberation and democratic control—delaying an ‘evidence-based’ system for public debate, presumably, only leads to losses in efficiency that would benefit all. In contrast, for years scholars have argued and demonstrated that smart city technology is far from neutral, instead preserving the existing social order through systemic injustices, biases, inequalities and power structures (Anttiroiko 2013; Foth et al. 2015; Galdon-Clavell 2013; Graham 2012; Hollands 2014; Kitchin 2015a; Odendaal 2016; Pali and Schuilenburg 2019; Watson 2013).

As these systems act faster and increase in complexity, public scrutiny will not only be obstructed through secretive intellectual property, trade secrecy agreements or anti-terrorism legislation. Rather than eroding the privacy of all, current trends restructure privacy in favour of the already powerful. While data collection practices on the general population, and especially vulnerable groups, increases aggressively, surveillance capitalists and state agencies have seen an increase in their right to secrecy (Zuboff 2015). The required advanced technical expertise and infrastructure will act as a powerful gatekeeper to these secrets and power (West 2019). Already today, there is limited understanding of how and based on which criteria big data algorithms arrive at the conclusions they do (Dourish 2016; Foth et al. 2018; Wigan and Clarke 2013), which may imply life-altering consequences for individuals (Markou 2017) such as being “sent to prison by a software program’s secret algorithms” (Liptak 2017).

This ignorance, in fact, constitutes an effective strategy for power holders to sidestep public accountability, obfuscating the connection between themselves and the consequences of their smart-city-enabled agendas. The automated, ‘impartial’ system decided without human intervention, they might say. Yet by encoding historic biases through the training data and their purpose of existence, ‘smart’ urban technologies perpetuate neoliberal and colonial-imperialist logics of austerity, extractivism, dispossession, surveillance and social control (Cardullo et al. 2018; Carlson et al. 2020; Coleman 2004; Grossi and Pianezzi 2017; Sadowski and Pasquale 2015). The technology-mediated decision makes it difficult to trace the progression from an individual making a decision, to its enacting and finally its eventual harmful consequences. Dilemmas around legal accountability for accidents caused by autonomous vehicles (Rizaldi and Althoff 2015) offer a glimpse into much more complex issues to come regarding the accountability of autonomous systems (Pagallo 2017)—at a societal and potentially global level.

In summary, the underlying currents of city automation that we question in this article are (a) the distribution of accountability; (b) obfuscation of responsibility; (c) the increasing reliance on vast amounts of data and reduction of dependency on human feedback and decision-making; (d) the consolidation of power under the neoliberal nexus between state and corporations that; (e) results in informational and technological asymmetries between state and corporate actors and individuals,
and; (f) the exertion of social control over these individuals through punishment and incentives.

The problematic currents that we identified in the previous section compel us to ask the provocative question whether automating cities risks automating oppression through the automated control of human behaviour. This shapes into what Zuboff (2015) terms an “un-contract,” which ultimately “replaces the rule of law and the necessity of social trust as the basis for human communities with a new life-world of rewards and punishments, stimulus and response” (p. 86). In particular, in combination with the trend towards increased independence from human oversight and control, democracy is a threat, rather than an asset, to surveillance capitalism and the surveillance state. This then begs the question whether there is an alternative approach for cities and citizens to take advantage of automation and smart city technology without losing their agency and autonomy. This is where we draw attention to the notion of technological sovereignty.

3 The Case for Technological Sovereignty

While we acknowledge that (a) the definition of the term ‘technological sovereignty’ is still contested, and; (b) the underlying concepts are not a catch-all solution to contemporary urban issues, we argue that a more critical and empowering approach to ownership and control over personal data and urban technologies constitute a meaningful response to issues of power asymmetries and inequitable distribution of benefits. This is achieved through the embodiment of social, political and economic rationales that defy those of state and capitalist surveillance and control.

Couture and Toupin (2019) define technological sovereignty as “various forms of independence, control, and autonomy over digital infrastructures, technologies, and data” and “collective control on digital content and/or infrastructures” (p. 1). Lynch argues for technology to be re-embedded into the social sphere, so as to render it “transparent” and “democratic”. Initiatives of technological sovereignty that seek to empower urban residents and collectives (Hache 2014) focus on social and community wellbeing, rather than corporate profits. Fundamental to this is linking technological sovereignty to aspirations of equality, justice and redress (Galdon 2017). And finally, in its attempt to invert asymmetric imbalances in power as well as access and control over data and technology, we view technological (and data) sovereignty primarily as a political intervention that requires adequate support through legislative frameworks and policy. We join Galdon (2017) in welcoming technological sovereignty as “another pillar on which to gradually construct and consolidate a new technological model that is ethical, responsible and civic” (para. 19).

As smart city automation comes under increasing scrutiny from both citizens and urban researchers, two recent smart city developments have been held up as contrasting examples of how to approach (or not to approach) citizen data collection and data governance in the smart city: namely, Alphabet/Google’s Sidewalk Labs’ Waterfront Toronto development, and Barcelona’s approach under its Digital
City Plan (see Barns 2020; Calzada and Almirall 2019; Galdon 2017; Lynch 2019a; Mann et al. 2020; March and Ribera-Fumaz 2018). The Waterfront Toronto project has been widely critiqued for what Mosco (2019) calls its “failure to engage the Toronto community on privacy and data control issues” (p. 89) and has faced significant citizen backlash and community activism under the hashtag #BlockSidewalk (Wylie 2018). For data analytics vanguards such as Google, it seems only logical to integrate its mobile data collection via the Android mobile phone operating system with the IoT sensor-based initiative championed by its subsidiary, Sidewalk Labs. This controversial Waterfront Toronto project is heralded as a city “built from the internet up” (Doctoroff 2016). Vast amounts of data will enable it to be automated, adaptive, responsive and personalised, Google claims. Yet, with its web-like foundation, it will rather resemble what Zuboff (2015) terms the Big Other—a perhaps more concerning, distributed and largely uncontested form of power in the pursuit of corporate profits, which also risks jeopardising the civic sovereignty of the city of Toronto.

In contrast, more recently, Barcelona has been held up for the opposite reasons for its attempt to move beyond its early corporate smart city model. Barcelona’s approach, as put forward in its Digital City Plan (2019), is, as Mosco (2019) explains, part of a global municipalism movement and is distinct from other smart city developments in the way that it “put[s] citizenship first, ahead of technology” (pp. 155–56). Specifically, Barcelona’s approach both embeds and advocates for technological sovereignty as a way to empower the citizens and residents of Barcelona to play a significant and active role in “deciding how the city’s technological infrastructure works and for what purpose” as well as placing responsibility on the City Council to give control of data and its economic value “back to the people” (Ajuntament de Barcelona 2019, p. 26). For Ribera-Fumaz (2019), Barcelona’s strategy of technological sovereignty has “been instrumental in re-politicising the notions of (smart) citizenship and technology, deploying initiatives aimed at regaining public control on data and citizens participating in policy-making” (p. 177).

What does technological sovereignty look like in practice? First, Barcelona has committed to three broad principles: (a) the transition and use of free software; (b) the interoperability of services and systems, and; (c) the use of open standards. This is coupled with a robust citizen engagement and participation platform called Decidim, which supports the city in direct consultation with its citizenry.

A commitment to technological sovereignty requires a city also to replace existing proprietary solutions, which usually risk a vendor lock-in, with alternatives that support open standards, open data, and interoperability (Raetzsch et al. 2019; Robinson et al. 2012). For example, the Open & Agile Smart Cities (OASC) network is a non-profit, international smart city community of practice comprising over 140 cities globally across 27 countries and regions. Driven by implementation and focused on open platforms and citizen engagement, OASC member cities have started to

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1. barcelona.cat/digitalstandards/en/tech-sovereignty.
2. decidim.barcelona.
3. oascities.org.
establish “Minimal Interoperability Mechanisms” (MIMs). They consist of a set of common, real-time APIs to access data; context information to structure data, and; a common, but optional, data platform to store and serve data. In addition, a reference architecture and a reference implementation complete the set of MIMs.

Additional approaches to technological sovereignty are emerging. For example, rather than a centralised, proprietary cloud-based data store architecture, there are decentralised data stores, data commons, data cooperatives, and data trusts emerging that use blockchain and decentralised ledger technology (Foth 2017; Wigan and Clarke 2013). One such approach is the decentralised Solid ecosystem, which allows citizens to maintain their data in personal data pods (Buyle et al. 2020).

The fast-paced nature of this technology development space makes it difficult for cities to keep up, make informed investment decisions, and maintain good data governance practices and policies. In response, our research aims to solve this problem for cities committed to technological sovereignty. We therefore created not a technical solution, but a framework that allows cities to systemically integrate good data practices (Daly et al. 2019) as a way to maintain their social licence to operate smart city technology. This is the idea behind the DataCare model.

4 DataCare for Smart Cities

Automation, big data analysis, and related technologies can make cities more liveable, sustainable, and equitable. Yet, the case of the Waterfront Toronto development shows that an uncritical commitment to technological ‘progress’ is one-sided and lacks the critical awareness required to deliver on more than just commercial goals. This is in stark contrast with the case of Barcelona and its smart city initiative, which illustrates that it is possible to support technological development without forgetting about the socio-cultural implications for citizens and communities. The way Barcelona implements principles of technological sovereignty suggests that you can have both: innovate, and safeguard the needs and interests of citizens and communities. It is not a zero sum game. Inspired by this example, we set out to create a vision for a model that allows municipal authorities and local governments to incorporate a systemic commitment to these values and enact them in practice in the form of a type of living lab (Dezuanni et al. 2017).

We commenced this ongoing research project with a year-long pilot study starting at the end of 2018 led by an interdisciplinary team comprising expertise in urban informatics, human-computer interaction, media and communications, human geography, criminology and justice, and technology regulation and privacy. The team was further complemented by support, advice, in-kind support and funding from industry and government partners. In this section, we report on this study, which starts to respond to some of the issues examined so far by proposing a set of good data practices that embed privacy-by-design and autonomy-by-design principles for

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future-proofing smart cities and protecting individual and collective autonomy, and a city’s civic sovereignty. We call this model **DataCare**. DataCare increases data transparency and access, showcases sustainable and civicly-minded business opportunities and empowers citizens. DataCare⁵ is a model for a dedicated facility offered by the city to citizens, communities, and businesses. The DataCare space can be tailored to accommodate four key scenarios: (a) raise awareness of data concerns and data ethics; (b) run data literacy training seminars; (c) engage in participatory data analytics, and; (d) speculate about (utopian and dystopian) city data futures. We now briefly summarise the design-led research process that informed and led to the DataCare model before we introduce these four scenarios.

This project responded to a real-world and pressing need to raise the awareness of policy makers and technologists to ethical design principles and practices and to develop new and innovative ways of putting end-users in charge. This project engaged technology experts, designers, government officials and end-users in igniting social change. A series of workshops⁶ using a ‘hackathon’ format were held between 2018 and 2019 to bring together relevant user groups (e.g., social media users, software engineers, interaction designers, policy makers, and government representatives). The aims of these workshops were to help these groups: forecast issues; design interventions to inform real-world practice, and; identify end-user needs and concerns. This interdisciplinary co-design approach drew on interaction design principles and practice. In June 2019, we collaborated with our industry partner ThoughtWorks on a week-long design intensive, which allowed the project team to collectively conceptualise and design the DataCare model and present it to industry and government stakeholders.

Following the design intensive, the team held two events to further scrutinise and evaluate the DataCare model. First, we convened a co-design workshop (Foth and Turner 2019; Huybrechts et al. 2017) hosted by ThoughtWorks Brisbane on 27th June 2019, and invited representatives from the project’s partner organisations as well as additional smart city stakeholders from industry, government, and academia. The workshop was broken into two parts: (a) a plenary style discussion panel titled “A Social Licence to Operate? Empowering the Citizen in the Smart City” comprising five representatives from industry, government, and academia, and; (b) group-based design ideations and discussion. Insights from this workshop pointed to a number of directions for follow-up research by yielding theoretical and practical questions, ideas and approaches regarding (a) the operationalisation of a social licence to operate smart cities, and; (b) data privacy-by-design and autonomy-by-design (see Fig. 1).

The second public event entailed a dedicated session held in conjunction with Smart Cities Week 2019 in Sydney on 30th November 2019 to present key results of this pilot study to conference delegates and present the DataCare model for feedback. Smart Cities Week⁷ is one of Australia’s key gatherings of smart cities leaders coming

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⁵ datacare.urbaninformatics.net.
⁶ The study received approval from the University Human Research Ethics Committee (1700000037).
⁷ australia2019.smartcitiesweek.com.
To network, exchange and create opportunities for accelerating the region’s uptake of smart city technology and data solutions. We were assigned a dedicated session themed around “Civic data and innovation in the smart city: Unlocking the potential of citizens with new models of social value.”

Based on feedback from these two events, we refined the DataCare model and collected suggestions and ideas for advancing and deepening our project’s inquiry into concerns of data ethics and technological sovereignty. Feedback from our event delegates and study participants confirmed DataCare’s premise that smart cities can and should be about more than automation and mass surveillance. The promise of a truly effective smart city is one that is citizen-led; that asks first what citizens need and how the city can be better, and that aligns the data collection and technology automation agenda to those needs, rather than the other way around. When done right, smart cities can help to streamline operations, restore trust in public institutions, and enhance inclusion and democracy.

DataCare is foremost a dedicated space similar to a living lab (Dezuanni et al. 2017), which is hosted and maintained by a local government or municipal authority to offer a range of smart city services to the public. Rather than a one-way service provision, DataCare establishes an ongoing dialogue between the city and its citizens. It thus generates a return on the city’s investment in the space by delivering a constant source of ideas, feedback and citizen-led smart city innovation. Feedback from our co-design workshops suggests that it could be deployed in a mobile or nomadic fashion (Foth et al. 2018). Additionally, libraries have been suggested as ideal hosts...
for this facility, especially if a city already has a network of library branches. This could improve space accessibility to a diversity of users as well as offer synergies with a range of existing personnel, digital infrastructure and educational resources that libraries offer (Bilandzic and Foth 2014; Houghton et al. 2013). Moreover, libraries also lend themselves as ideal destinations for integrating DataCare due to their commitment to connected learning and community education (Bilandzic and Foth 2017).

The DataCare prototype model entails four key service provisions (see Fig. 2):

- **Data Awareness**: Help communities understand the collection and use of data in smart cities and identify data possibilities and opportunities;
- **Data Literacy**: Provide data training workshops and education so that citizens can take control and be engaged in smart cities;
- **Data Action**: Work together with citizens and community groups to collaboratively use data tools to syndicate their data and operate data cooperatives or trusts, to harness collective insights and value from shared data, and;
- **Data Futures**: Bring citizens, businesses and city administrators together in speculative design futuring activities about alternative and desirable urban data governance arrangements.

These services and associated space configurations of the DataCare facility will empower citizens, community groups, city administrators and businesses to share data to generate insights to make our cities better. They also provide a tiered approach to prepare a city and its citizens for maintaining data and technological sovereignty by first raising awareness of data related concerns and improving levels of data literacy before engaging in data actions and data futures. We will now discuss each use case in turn.

*Fig. 2* DataCare comprises four use cases and associated space configurations: data awareness in the clinic; data literacy in the seminar; data action in the lab, and; data futures in the studio configuration


4.1 Data Awareness

The first service we envisaged for the DataCare space is geared towards helping citizens, businesses and communities understand the collection and use of data in smart cities and identify both data possibilities and opportunities, as well as challenges and concerns. The space configuration associated with raising awareness of data issues is the **DataCare Clinic**. Those seeking advice and guidance may benefit from speaking to one of the in-house data scientists specifically trained in teaching good data practices.

In response to public pressure, many technology and platform corporations have started to make user data available to individuals. Facebook offers users to ‘Download your information’\(^8\) and Google provides data associated with a user’s Google account to be downloaded from Google Takeout\(^9\) in a number of formats (JSON, XML, etc.). Smart city data services are also increasingly embracing accessible open data warehouses as well as ways for individuals to download the data a city collects and holds about them (Anastasiu et al. 2020). However, what do you do once you have downloaded such datasets? How do you interrogate them? How do you gauge whether a service’s data collection and processing should raise concerns? In the DataCare Clinic, data scientists work with citizens to answer these questions. Collaboratively, they use participatory data visualisation tools (Filonik et al. 2014) such as Heat Map\(^10\)—a tool to visualise location histories; Palladio\(^11\)—a web-based tool that lets you visualise data as maps, graphs, lists or galleries, and; Gephi\(^12\)—a data tool that can be used for building graphs and networks.

A typical usage scenario for the DataCare Clinic: **Ellen uses an RFID enabled smart card to access her city’s public transport network and pay for fares. She came to DataCare concerned about the collection of her location data while using this smart card. Ellen collaboratively worked with a data specialist, and together they retrieved the location history of her public transport trips and used open source tools to visualise the data on a map of the city. This gave Ellen greater understanding and awareness of the collection and storage of her data by the services she uses in the city, and how analysing this data also serves the public transport system in running more smoothly.**

4.2 Data Literacy

DataCare provides data literacy workshops, training and education so that citizens can take individual and collective control and ownership of data governance arrangements.

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\(^8\) facebook.com/dyi.  
\(^9\) takeout.google.com.  
\(^10\) locationhistoryvisualizer.com/heatmap.  
\(^11\) hdlab.stanford.edu/palladio.  
\(^12\) gephi.org.
and be engaged in and empowered by smart city technology. This second space configuration the facility offers are the **DataCare Seminars**.

While digital literacy training is by now a standard offering in the portfolio of training and services provided by many libraries, feedback from our study participants identified a specific shortcoming pertaining to the legal and ethical dimensions of data collection and analysis. For example, a digital literacy training event that supports senior citizens in using their smartphones to stay connected with their family and friends may entail installing and then practising using communication and chat apps such as Facebook Messenger, Whatsapp, Skype, Zoom, or WeChat. Each of these services presents the user with a long list of terms and conditions outlining what data is being collected by the service, what will happen to it, and if third parties will access it, too. Yet, these terms and conditions are often complex, written in inaccessible legalese so as to raise concerns whether they offer a genuine mechanism to obtain a user’s informed consent (Luger et al. 2013). Additionally, librarians in their role of digital literacy training facilitators feel ill-equipped in interpreting the meaning of these terms and conditions, and offering participants any sort of legal or ethical advice may be in violation of legal and professional codes of conduct (McLaughlin 2015).

In response, the DataCare Seminars pick up where conventional digital literacy training left off. For example, the courses, classes and seminars may cover topics such as privacy in everyday life, how to protect your data and how to use data analysis tools, among others. Based on the requirements of participants, DataCare provides relevant educational material presented by independent experts in the field. The benefit is empowerment of people through awareness and development of skills and data literacies.

A typical usage scenario for the DataCare Seminars: **Younghui really enjoyed her first visit to attend a DataCare Clinic. She left being more inquisitive wanting to find out more about how her individual data is being used across the smart city to enable services she has been taken for granted. She has also accessed a directory of ethical, easy-to-use and privacy-conscious alternatives to well-known software and platforms**¹³ and has started to switch some of the digital services she uses. However, she recently received a text message from the Australian Government that left her in doubt: “Coronavirus Aus Gov msg: Help us to keep you safe and ease restrictions by downloading the COVIDSafe app now: aus.gov.au/app.” Having read different news coverage on the topic, Younghui is unsure and undecided whether she should install this app. The more she looks into it, the more she realises how complex these topics are. She attends a virtual DataCare Seminar on the COVIDSafe app, which improves her understanding and better equips her to make an informed decision whether to install the app or not.

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¹³ [switching.software](https://www.switching.software).
4.3 Data Action

DataCare empowers citizens, community groups, city administrators, and businesses to share data and generate insights to make our cities better. However, rather than being industry-led and thus profit-led, DataCare is citizen-led and committed to interoperability and technological sovereignty. For example, it allows citizens to syndicate their data into data cooperatives or trusts as a way to harness collective insights and value from shared data.

In order to enable citizens, community groups, and businesses to take full advantage of available smart city infrastructure for what we call data action, the DataCare facility can be configured as a DataCare Lab. The space configuration for this use case allows different groups of people to come together and use existing but also co-create and co-design new smart city data services (Spagnoli et al. 2019). Based on principles of technological sovereignty, the DataCare Lab offers a mechanism by which the increased efficiency and effectiveness dividends produced by smart city technology investment for the common good can be shared across a wider and more diverse group of stakeholders.

However, the nascent innovation potential of open standards and interoperability remains dormant without an active commitment to widening participation, inclusion, and empowerment through civic and community engagement (Foth and Adkins 2006; Foth and Brynskov 2016). Therefore, the DataCare Lab invites and welcomes citizens, community groups and small businesses to take advantage of professional data visualisation tools and rigorous data analysis methods that are usually out of reach due to their cost and complexity. As a result of often lacking a genuine engagement strategy, conventional smart city data applications are often inaccessible and risk excluding many people and groups. In turn, the sophistication and high fidelity with which smart city data analysis results are being rendered and presented to the public risks citizen and community ‘bedazzlement’ (Foth et al. 2018), which evades community critique and public discourse. The staff, resources, and inventory of the DataCare Lab can be used instead to empower local communities to engage in participatory citymaking efforts based on data actions and activism.

A typical usage scenario for the DataCare Lab: A local cycling advocacy group was able to successfully use DataCare and its features to demonstrate the case for better bike paths in the city. Group members booked a DataCare Lab and first used a heat map to visualise the location data captured by their members’ phones as they cycle around the city. Members then shared their data with each other in a secure manner using a single-instance server where the content was hosted locally and removed at the end of the session. This prevented the group’s data from being leaked outside of the session. By collecting, aggregating and analysing their heat maps into a collective data set, the group was able to demonstrate the common network of paths that they use in the city. Backed by this empirical data, the group was able to raise safety concerns with city officials and urban planners and advocate for an additional green bridge over the city’s river as well as dedicated, protected bike lanes in the city’s CBD.
4.4 Data Futures

Finally, the fourth space configuration of the DataCare facility brings citizens, businesses and city administrators together to speculate about alternative and desirable city data futures. We call the configuration for this use case the DataCare Studio, borrowing from design charrettes and design studios (Roggema 2013). The Studio puts power back in the hands of the people whose data may have been collected without an understanding of the full implications of gathering such data.

The studio employs value scenarios (Nathan et al. 2007, 2008), urban imaginaries (Estrada-Grajales et al. 2018; Foth et al. 2020), and speculative design fiction methods (Dunne and Raby 2013; Forlano and Mathew 2014; Galloway and Caudwell 2018). Combining different technology deployment strategies, social usage profiles and conditions, policy and regulatory frameworks, data governance arrangements, and external factors, allows the Studio to examine a range of possible usage scenarios. They span across a spectrum from optimist-utopian to pessimist-dystopian outcomes. Rather than a one-sided investment pitch from commercial providers and technology advocates, the DataCare Studio enables a local government or city municipality to make better and more informed investment decisions. Using the data futures approach the Studio offers, these can now be based on a thorough understanding of both benefits and risks, of both intended and unintended consequences of smart city technology deployments. The Studio’s approach facilitates valuable discussion and engagement to take place between the city, citizens, community groups and industry, which has traditionally not occurred.

A typical usage scenario for the DataCare Lab: The local city authority is being approached by the sales agent of a manufacturer of smart street poles. City officials are told that investing in smart street poles is a good idea, because they offer an integrated solution combining context-aware LED lighting; connectivity nodes for WiFi, 4G/5G mobile networks, LoRaWAN; CCTV surveillance cameras; speakers; IoT data sensors; digital wayfinding signage; USB charging for pedestrians; and powerpoints for use during local events. The city officials are intrigued, but they are also wary of community backlash around privacy and mass-surveillance leading to an Orwellian smart city. They remember seeing pictures in the news media reporting the 2019 Hong Kong protests showing protesters toppling smart lamp posts over fears they host the capability for facial recognition, enabling identification by Chinese officials (ABC News 2019). The city officials book a dedicated session in the DataCare Studio. It brings them into one room with citizens, small businesses, community groups representing a mix of proponents and opponents of smart street poles. The speculative design fiction workshop allows the city officials to consider a range of possible future scenarios, and plan the deployment of a small-scale trial that is accompanied with a policy and regulatory framework informed by international best practice.
5 Conclusion

We live in a world where more data is being collected than ever before. This data offers enormous potential to improve our cities and social spaces, but there are risks, too. What is problematic about data is the many ways that one can deal with it. Although people contribute much of the data upon which the smart city operates, its systems often remain closed off to public understanding, scrutiny and control. There are also concerns around privacy and loss of autonomy.

We care about enhancing privacy without removing the usefulness of data connections; improving the autonomy of citizens to have real choices about how their data is used, and; making smart cities more liveable, sustainable, and equitable. This requires a reversal of the asymmetrical relationship between data collectors and citizens, where citizens become empowered, understand how their data is used, and are able to use their data for the public good. Technological sovereignty and data sovereignty mean citizens have control over their data and the associated technology platforms, and are able to use them for their individual benefit, for allowing city services to operate, as well as for the common good. The DataCare model offers a framework that allows cities committed to principles of technological sovereignty to systematically integrate good data practices.

Our program of research into technological sovereignty and DataCare has only just begun, and there is plenty more work to be done to make the DataCare vision a reality. Future work will further test and evaluate the use cases as well as investigate different approaches to them. We also want to identify additional use cases and space configurations, different workshop and studio methods, and different usage scenarios for each case. In all of this, we are also mindful of current limitations and the risks of the DataCare facility being used (and abused) by cities for ‘engagement theatre,’ tokenism, and cooptation while they go about business-as-usual at the back of house (Teli et al. 2020). The characteristics and pitfalls of participatory approaches in the neoliberal city have been examined in the literature (Cardullo et al. 2018; Cardullo and Kitchin 2019; Lodato and DiSalvo 2018; Mattern 2020). In order to mitigate against some of these risks, our program of research has started to contribute to current debates around infrastructuring in participatory design and extended the discourse into concerns around scale, impact and institutioning (Foth et al. 2015; Foth and Turner 2019; Frauenberger et al. 2018). We are now working on applying these approaches to the DataCare prototype in order to further refine and extend it.

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References

ABC News (2019) Hong Kong Protesters Cut Down Data-Collecting Lamppost. ABC News; Australian Broadcasting Corporation. https://www.abc.net.au/news/2019-08-24/hong-kong-protests-smart-lampposts-cut-down-surveillance-fears/11445606

Ajuntament de Barcelona (2019) Barcelona Digital City: Putting technology at the service of people. https://ajuntament.barcelona.cat/digital/sites/default/files/pla_barcelona_digital_city_in.pdf

Alvares CA (1976) Homo faber: technology and culture in India, China and the west 1500–1972 [Technische Hogeschool Eindhoven]. https://research.tue.nl/files/3474012/68612.pdf

Anastasiu I, Foth M, Schroeter R, Rittenbruch M (2020) From repositories to switchboards: local governments as open data facilitators. In . Hawken S, Han H, Pettit C (eds) Open cities | Open data: collaborative cities in the information era. Springer Singapore, pp 331–358. https://doi.org/10.1007/978-981-13-6605-5_15

Andrejevic M, Gates K (2014) Big data surveillance: introduction. Surveillance & Society 12(2):185–196

Angelidou M (2017) Smart city planning and development shortcomings. Tema. J Land Use Mobil Environ 10(1):77–94. https://doi.org/10.6092/1970-9870/4032

Anttiroiko A-V (2013) U-cities reshaping our future: reflections on ubiquitous infrastructure as an enabler of smart urban development. AI & Soc 28(4):491–507. https://doi.org/10.1007/s00146-013-0443-5

Barns S (2020) Platform urbanism: negotiating platform ecosystems in connected cities. Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-987-13-9272-8

Bilandzic M, Foth M (2014) Learning beyond books—strategies for ambient media to improve libraries and collaboration spaces as interfaces for social learning. Multimed Tools Appl 71(1):77–95. https://doi.org/10.1007/s11042-013-1432-x

Bilandzic M, Foth M (2017) Designing hubs for connected learning: Social, spatial and technological insights from Coworking, Hackerspaces and Meetup groups. In Carvalho L, Goodyear P, de Laat M (eds) Place-based spaces for networked learning. Routledge, pp 191–206. https://doi.org/10.4324/9781315724485-14

Brayne S (2017) Big data surveillance: the case of policing. Am Sociol Rev 82(5):977–1008. https://doi.org/10.1177/0003122417725865

Burgers T, Robinson DRS (2016) Networked authoritarianism is on the rise. Sicherh Und Frieden (S + F) / Secur Peace 34(4):248–252. https://doi.org/10.5771/0175-274X-2016-4-248

Buyle R, Taelman R, Mostaert K, Joris G, Mannens E, Verborgh R, Berners-Lee T (2020) Streamlining governmental processes by putting citizens in control of their personal data. Electron Gov Open Soc Chall Eurasia 346–359. https://doi.org/10.1007/978-3-030-39296-3_26

Calzada I, Almirall E (2019) Barcelona’s grassroots-led urban experimentation: deciphering the “data commons” policy scheme. Zenodo. https://doi.org/10.5281/zenodo.2604618

Cardullo P, Kitchin R (2019) Smart urbanism and smart citizenship: the neoliberal logic of “citizen-focused” smart cities in Europe. Environ Plan C Polis Space 37(5):813–830. https://doi.org/10.1177/0263774X18806508

Cardullo P, Kitchin R, Di Felicianonio C (2018) Living labs and vacancy in the neoliberal city. Cities 73:44–50. https://doi.org/10.1016/j.cities.2017.10.008

Carlson A, Sadowski J, Osborne N (2020, February 4) Darwin’s “smart city” project is about surveillance and control. The Conversation. https://theconversation.com/darwins-smart-city-project-is-about-surveillance-and-control-127118

Cavoukian A (2012) Privacy by design: origins, meaning, and prospects for assuring privacy and trust in the information era. In Yee GOM (ed) Privacy protection measures and technologies in business organizations: aspects and standards. IGI Global, pp 170–208. https://doi.org/10.4018/978-1-61350-501-4.ch007

Coleman R (2004) Images from a Neoliberal City: the state, surveillance and social control. Crit Criminol 12(1):21–42. https://doi.org/10.1023/B:CRIT.0000024443.08828.d8
From Automation to Autonomy: Technological Sovereignty …

Cosgrave E, Arbuthnot K, Tryfonas T (2013) Living labs, innovation districts and information markets: A systems approach for smart cities. Proced Comput Sci 16:668–677. https://doi.org/10.1016/j.procs.2013.01.070

Couture S, Toupin S (2019) What does the notion of “sovereignty” mean when referring to the digital? New Media Soc 21(10):2305–2322. https://doi.org/10.1177/1461444819865984

Cugurullo F (2018) Exposing smart cities and eco-cities: Frankenstein urbanism and the sustainability challenges of the experimental city. Environ Plan A 50(1):73–92. https://doi.org/10.1177/0308518X17738535

Daly A, Devitt SK, Mann M (2019) Good data. Institute of Network Cultures. http://eprints.qut.edu.au/125605

Dezuanni M, Foth M, Mallan K, Hughes H (eds) (2017) Digital participation through social living labs: Valuing local knowledge, enhancing engagement. Chandos Publishing. https://doi.org/10.1016/C2016-0-01911-3

Doctoroff DL (2016) Reimagining cities from the internet up. Medium; Sidewalk Talk. https://medium.com/sidewalk-talk/reimagining-cities-from-the-internet-up-5923d6be63ba

Dodd V, Grierson J (2020, January 22) Non-violent groups on UK counter-terror list threaten legal action. The Guardian. http://www.theguardian.com/environment/2020/jan/22/minister-denies-government-considers-extinction-rebellion-extremist

Dourish P (2016) Algorithms and their others: algorithmic culture in context. Big Data Soc 3(2). https://doi.org/10.1177/2053951716665128

Dunne A, Raby F (2013) Speculative everything: design, fiction, and social dreaming. MIT Press

Estrada-Grajales C, Foth M, Mitchell P (2018) Urban imaginaries of co-creating the city: local activism meets citizen peer-production. J Peer Prod, 11. https://eprints.qut.edu.au/116171/

Filonik D, Rittenbruch M, Foth M (2014) Participatory data analytics: collaborative interfaces for data composition and visualisation. Proceedings of the 7th international symposium on visual information communication and interaction, pp 248–249. https://doi.org/10.1145/2636240.2636873

Forlano L, Mathew A (2014) From design fiction to design friction: speculative and participatory design of values-embedded urban technology. J Urban Technol 21(4):7–24. https://doi.org/10.1080/10630732.2014.971525

Forrest R, Wissink B (2017) Whose city now? Urban managerialism reconsidered (again). The Sociol Rev 65(2):155–167. https://doi.org/10.1111/1467-954X.12415

Foth M (2017) The promise of blockchain technology for interaction design. Proceedings of the 29th Australian conference on computer-human interaction, pp 513–517. https://doi.org/10.1145/3152771.3156168

Foth M, Adkins B (2006) A research design to build effective partnerships between city planners, developers, government and urban neighbourhood communities. J Commun Inform 2(2). http://ci-journal.net/index.php/ciej/article/viewArticle/292

Foth M, Brynskov M (2016) Participatory action research for civic engagement. In: Gordon E, Mihailidis P (eds) Civic media: technology, design, practice. MIT Press, pp 563–580

Foth M, Turner TJ (2019) The premise of institutioning for the proliferation of communities and technologies research. Proceedings of the 9th international conference on communities & technologies-transforming communities, pp 24–28. https://doi.org/10.1145/3328320.3328398

Foth M, Brynskov M, Ojala T (2015) Citizen’s right to the digital city. Springer, Berlin. https://doi.org/10.1007/978-981-287-919-6

Foth M, Tomitsch M, Satchell C, Haeusler MH (2015) From users to citizens: some thoughts on designing for polity and civics. Proceedings of the annual meeting of the Australian special interest group for computer human interaction, pp 623–633. https://doi.org/10.1145/2838739.2838769

Foth M, Caldwell G, Fredericks J, Volz K (2018) Augmenting cities beyond bedazzlement: empowering local communities through immersive urban technologies. Workshop proceedings of augmenting cities and architecture with immersive technologies, pp 1–4. https://eprints.qut.edu.au/122841/
Katz, B, Wagner, J. (2014) The Rise of Innovation Districts: A New Geography of Innovation in America. Brookings Institution–Metropolitan Policy Program

Kitchin R (2014) The real-time city? Big data and smart urbanism. GeoJ 79(1):1–14. https://doi.org/10.1007/s10708-013-9516-8

Kitchin R (2015a) The promise and peril of smart cities. Comput Law J Soc Comput Law 26(2):1–5. https://www.scl.org/articles/3385-the-promise-and-perils-of-smart-cities

Kitchin R (2015b) Data-Driven, Networked Urbanism. SSRN. https://doi.org/10.2139/ssrn.2641802

Kitchin R (2017) Data-driven urbanism. In Kitchin, R, Lauriault, TP, McArdle, G (eds), Data and the City. Routledge, pp 44–56. https://doi.org/10.4324/9781315407388-4

Leszczynski A (2015) Spatial big data and anxieties of control. Environ Plan. D Soc Space 33(6):965–984. https://doi.org/10.1080/02637758159595814

Liptak A (2017) Sent to prison by a software program’s secret algorithms. The New York Times. https://www.nytimes.com/2017/05/01/us/politics/sent-to-prison-by-a-software-programs-secret-algorithms.html

Lodato T, DiSalvo C (2018) Institutional constraints: the forms and limits of participatory design in the public realm. Proceedings of the 15th participatory design conference: full papers-Volume 1, 5. https://doi.org/10.1145/3210586.3210595

Luger E, Moran S, Rodden T (2013) Consent for all: revealing the hidden complexity of terms and conditions. Proceedings of the SIGCHI conference on human factors in computing systems, pp 2687–2696. https://doi.org/10.1145/2470654.2481371

Lynch CR (2019) Contesting digital futures: urban politics, alternative economies, and the movement for technological sovereignty in Barcelona. Antipode 52(3):660–680. https://doi.org/10.1111/anti.12522

Macrorie R, Marvin S, While A (2019) Robotics and automation in the city: a research agenda. Urban Geogr 1–21. https://doi.org/10.1080/02723638.2019.1698868

Mann M, Mitchell P, Foth M, Anastasiu I (2020) #BlockSidewalk to Barcelona: technological sovereignty and the social licence to operate smart cities. Journal of the Association for Information Science and Technology (JASIST), 71(9), 1103-1115. https://doi.org/10.1002/ASI.24387

March H, Ribera-Fumaz R (2018) Barcelona: from corporate smart city to technological sovereignty. In Karvonen A, Cugurullo F, Caprotti F (eds), Inside Smart Cities: Place, Politics and Urban Innovation. Routledge, pp 227–242. https://doi.org/10.4324/9781351166201-15

Markou C (2017) Why using AI to sentence criminals is a dangerous idea. The Conversation. http://theconversation.com/why-using-ai-to-sentence-criminals-is-a-dangerous-idea-77734

Matern S (2020) Post-It note city. Places J. https://doi.org/10.22269/200211

McLaughlin PJ (2015) Wanting to do more but bound to do less: a law Librarian’s Dilemma. Ref Librar 56(2):119–132. https://doi.org/10.1080/02763877.2014.982316

Mosco V (2019) The smart city in a digital world. Emerald Publishing

Mozer P (2019) One month, 500,000 face scans: How China Is Using A.I. to profile a minority. The New York Times. https://www.nytimes.com/2019/04/14/technology/china-surveillance-artificial-intelligence-racial-profiling.html

Mozer P, Kessel JM, Chan M (2019) Made in China, exported to the world: the surveillance state. The New York Times. https://www.nytimes.com/2019/04/24/technology/ecuador-surveillance-cameras-police-government.html

Nathan LP, Klasnja PV, Friedman B (2007) Value scenarios: a technique for envisioning systemic effects of new technologies. CHI ’07 extended abstracts on human factors in computing systems, pp 2585–2590. https://doi.org/10.1145/1240866.1241046

Nathan LP, Friedman B, Klasnja P, Kane SK, Miller JK (2008) Envisioning systemic effects on persons and society throughout interactive system design. Proceedings of the 7th ACM conference on designing interactive systems, pp 1–10. https://doi.org/10.1145/1394445.1394446
Naughton J (2020) Quick, cheap to make and loved by police—facial recognition apps are on the rise. The Guardian. http://www.theguardian.com/technology/commentisfree/2020/jan/25/facial-recognition-apps-are-on-the-rise

O’Flaherty K (2020) Clearview AI’s database has amassed 3 billion photos. This is how if you want yours deleted, you have to opt out. Forbes Magazine. https://www.forbes.com/sites/kateoflahertyk/2020/01/26/clearview-ais-database-has-amassed-3-billion-photos-this-is-how-if-you-want-yours-deleted-you-have-to-opt-out/

O’Malley P, Smith G (2019) Disruption as distraction: Darwin’s smart city program, public resistance and the digitisation of racialised governance. Working paper

Odendaal N (2016) Smart city: neoliberal discourse or urban development tool? In: Grugel J, Hammett D (eds) The palgrave handbook of international development. Palgrave McMillan, pp 615–633. https://doi.org/10.1057/978-1-137-42724-3

Pagallo U (2017) From automation to autonomous systems: a legal phenomenology with problems of accountability. In Proceedings of the 26th International Joint Conference on Artificial Intelligence (IJCAI), pp 17–23. https://doi.org/10.24963/ijcai.2017/3

Pali B, Schulenburg M (2019) Fear and fantasy in the smart city. Criti Criminol, 1–14. https://doi.org/10.1007/s10612-019-09447-7

Peled A (2013) The politics of big data: a three-level analysis. https://doi.org/10.2139/ssrn.2315891

Raetzsch C, Pereira G, Vestergaard LS, Brynskov M (2019) Weaving seams with data: conceptualizing city APIs as elements of infrastructures. Big Data Soc 6(1). https://doi.org/10.1177/20539519827619

Rekow L (2015) Police, protests, and policy in Rio de Janeiro—mega-events, networked culture, and the right to the city. In: Foth M, Brynskov M, Ojala T (eds) Citizen’s right to the digital city: urban interfaces, activism, and placemaking. Springer, pp 119–135. https://doi.org/10.1007/978-981-287-919-6_7

Ribera-Fumaz R (2019) Moving from smart citizens to technological sovereignty? In the right to the smart city, pp. 177–191. https://doi.org/10.1007/978-1-78769-139-120191013

Rizaldi A, Althoff M (2015) Formalising traffic rules for accountability of autonomous vehicles. 2015 IEEE 18th international conference on intelligent transportation systems, pp 1658–1665. https://doi.org/10.1109/ITSC.2015.269

Robinson R, Rittenbruch M, Foth M, Filonik D, Viller S (2012) Street computing: towards an integrated open data application programming interface (API) for cities. J Urban Technol 19(2):1–23. https://doi.org/10.1080/10630732.2012.698064

Roggemann R (2013) The design charrette: ways to envision sustainable futures. Springer Science & Business Media

Rubinstein IS (2011) Regulating privacy by design. Berkeley Tech LJ 26:1409

Rubinstein IS, Good N (2013) Privacy by design: a counterfactual analysis of Google and Facebook privacy incidents. Berkeley Tech. LJ 28:1333

Sadowski J (2020) Too smart: how digital capitalism is extracting data, controlling our lives, and taking over the world. MIT Press

Sadowski J, Pasquale FA (2015) The spectrum of control: a social theory of the smart city. First Monday 20(7). https://doi.org/10.5210/fm.v20i7.5903

Satariano A (2020) London police are taking surveillance to a whole new level. The New York Times. https://www.nytimes.com/2020/01/24/business/london-police-facial-recognition.html

Spagnoli F, van der Graaf S, Brynskov M (2019) The paradigm shift of living labs in service co-creation for smart cities: Synchronicity validation. Organizing for Digital Innovation, pp 135–147. https://doi.org/10.1007/978-3-319-90500-6_11

Teli M, Foth M, Sciamamblo M, Anastasiu I, Lyle P (2020) Tales of institutioning and commoning: participatory design processes with a strategic and tactical perspective. Proceedings of the 16th participatory design conference (PDC), Manizales, Colombia. ACM, pp 159–171.

van Zoonen L (2016) Privacy concerns in smart cities. Gov Inf Quarterly 33(3):472–480. https://doi.org/10.1016/j.giq.2016.06.004
Veillette PT (1959) The rise of the concept of automation. In automation and society. Philosophical Library New York
Watson V (2013) African urban fantasies: dreams or nightmares? Environ Urban 26(1):215–231. https://doi.org/10.1177/0956247813513705
West SM (2019) Data capitalism: redefining the logics of surveillance and privacy. Bus Soc 58(1):20–41. https://doi.org/10.1177/0007650317718185
Wigan MR, Clarke R (2013) Big data’s big unintended consequences. Computer 46(6):46–53. https://doi.org/10.1109/MC.2013.195
Wylie B (2018) Sidewalk Toronto: Gaslighting Toronto Residents Backfired—Capacity’s Built and Power’s Shifted. Medium; Medium. https://medium.com/@biancawylie/sidewalk-toronto-gaslighting-toronto-residents-backfired-capacitys-built-and-power-s-shifted-77c455b150a3
Zuboff S (2015) Big other: surveillance capitalism and the prospects of an information civilization. J Inf Technol Impact 30(1):75–89. https://doi.org/10.1057/jit.2015.5
Zuboff S (2019) The age of surveillance capitalism: the fight for a human future at the new frontier of power. Profile Books