Selling Smartness

Corporate Narratives and the Smart City as a Sociotechnical Imaginary

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Abstract

This article argues for engaging with the smart city as a sociotechnical imaginary. By conducting a close reading of primary source material produced by IBM and Cisco over a decade of work on smart urbanism, we argue that the smart city imaginary is premised in a particular narrative about urban crises and technological salvation. This narrative serves three main purposes: (1) it is an overarching structure used to fit different ideas and initiatives into a coherent view of smart urbanism; (2) it is a vehicle to sell and spread this version of smartness; and (3) it serves to crowd out alternative visions and corresponding arrangements of smart urbanism. Furthermore, we argue that IBM and Cisco construct smart urbanism as both a reactionary and visionary force, plotting a model of the near future, but one that largely reflects and reinforces existing socio-political systems. We conclude by suggesting that breaking IBM's and Cisco's discursive dominance of the smart city imaginary requires us to reimagine what smart urbanism means and create counter-narratives that open up space for alternative values, designs, and models.

Introduction

Few urban development models are as popular as the smart city. Urban scholars, technology designers, municipal bureaucrats, and, of course, city dwellers may find it difficult to avoid the term and, no less important, to elude the consequences of its materialization. But just what is the smart city? What is this thing that seemingly exists in a liminal space between marketing and materiality, imagination and implementation, becoming and being? The answer is not clear (Angelidou, 2015; Hollands, 2008; McFarlane & Söderström, 2017). And while some definitions identify the smart city with its technical infrastructure, the smart city is not equivalent to any single technology or collection of technologies. The sensors, networks, and algorithms associated with the smart city could be deployed in other settings and contexts. What makes them "smart city technologies," therefore, is neither strictly technical (pertaining to functionality, instrumental causes, or driven by efficiency) nor entirely social (produced by specific actors, reflecting particular incentives, or embraced by certain institutions). Smart city technologies become smart city technologies only by association with the idea of the smart city and the narratives, logics, practices, and symbolism of which it is constituted. As a consequence, the smart city can be seen as both a container for innovation and a yardstick for evaluating innovation.

Ostensibly, “smartness” refers to the intelligence of technology. As the logical conclusion of the cybernetic dream of frictionless control, coordinated command, and optimal reactions, smartness serves as a measure of a technology’s context-specific adaptability. Smart systems are meant to deploy data-driven analytics, networked communication, and algorithmic decisions to respond in real-time to complex, dynamic situations (Kitchin, 2014). The ability to act autonomously, appropriately, and promptly is seen as a way to add value to a range of products and services, whereby scaling up the advancement of smartness will “force economic growth” and “force societal progress,” as IBM’s CEO, Ginni Rometty (2013b) proclaimed.

When smartness is projected onto the city as a whole, it exceeds its technical premise and becomes a cornerstone for an urban sociotechnical imaginary (Jasanoff & Kim, 2009; 2015): a set of ideas, beliefs, and visions about the future of urbanity. As a sociotechnical imaginary, the smart city is always in the process of becoming – expanding in both scope and reach. We aim to illustrate this process by critically analyzing documents produced by two of the largest players in the smart city marketplace of ideas and systems: IBM and Cisco. We argue that these documents comprise a narrative according to which the smart city appears as an inevitability, the only reasonable response to an impending urban crisis. At the same time, since the smart city as an “actually existing” sociotechnical assemblage is still nascent, we argue that the smart city is an anticipatory vision – even a self-fulfilling prophecy. It is a set of orienting assumptions and operationalizable propositions about urban planning and development. Indeed, smart urbanism is about the very constitution of what Saskia Sassen (2013) calls “cityness.” This paper, therefore, analyzes how corporate narratives seek to provide the parameters of cityness – and, in the process, preclude alternative imaginaries – by constructing and extending the smart city sociotechnical imaginary.

The Smart City as a Sociotechnical Imaginary

Sociotechnical imaginaries, writes Sheila Jasanoff, indicate “the myriad ways in which scientific and technological visions enter into the assemblages of materiality, meaning, and morality that constitute robust forms of social life” (2015a, p. 4). The concept encodes the imbrication of science, technology, and society – how “imagination, objects, and social norms… become fused in practice” (Jasanoff, 2015b, p. 321). This is reflected in the definition of sociotechnical imaginaries as “collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology” (Jasanoff, 2015a, p. 4). Sociotechnical imaginaries illustrate the symmetrical relation of technoscience and society, which results in the co-production of “political orders and technoscientific projects” (McNeil et al., 2017, p. 449). In a sense, then, the

presence of sociotechnical imaginaries undermines attempts to compartmentalize technoscientific and sociopolitical discourses, thus providing Science and Technology Studies with a much needed normative perspective (Jasanoff, 2015a, p. 5) while also expanding the conceptual vocabulary of critical constructivism (Feenberg, 2017).

Sociotechnical imaginaries cut through longstanding cultural categories built around the dyadic relations of mental and material phenomena. As a concept, they help us strike a better balance "between the theoretical poles of abstract idealism and deterministic materialism" (Jasanoff, 2015a, p. 22). By bridging idealism and materialism – that liminal space where the smart city exists – sociotechnical imaginaries play a critical role in framing what technology is made and why. "Whereas science and technology were formerly generally regarded as the domains of facts and artifacts, they are now also associated with storytelling, imaging, and imagining" (McNeil et al., 2017, p. 457). These mediums are where sociotechnical imaginaries are forged, stabilized, and propagated, and where alternative imaginaries compete for the power to establish which narratives and ideas take hold. When it comes to highly contested and highly consequential topics like the smart city or nuclear energy (Jasanoff & Kim, 2009), the competition to establish a particular sociotechnical imaginary is often dominated by powerful institutions.

With few exceptions (e.g., Smith, 2009; 2015), the majority of research on sociotechnical imaginaries has focused on the state as the central site for the evolution and expansion of sociotechnical imaginaries, specifically via national policies, regulations, and institutions (Jasanoff & Kim, 2009; McNeil et al., 2017). Our focus here, however, is on corporate actors. Although policymaking plays an important role in streamlining and applying smart city technologies – and governments have marshalled the discourses and practices of smart urbanism to enact austerity agendas (Pollio, 2016) and expand their power (Ho, 2017) – corporations originate and extend the smart city sociotechnical imaginary. Large technology vendors set the tone, enroll other actors, and weave the narratives that make possible the smart city's actualization (Hollands, 2015; Södeström et al., 2014).

In this vein, Hollands (2008) shows that the "smart city" label is an object of boundary work by those who wish to define and claim smartness on their own terms. This remains true today, as evidenced in recent work that examines the role of IBM, the largest smart city proprietor, in constructing smart urbanism through discursive means (Greenfield, 2013; McNeil, 2015; Wiig, 2015). Through an exploration of "the origin and development of IBM's pervasive and influential Smarter Cities strategies," McNeil (2015) describes how the company strategically shifted from a hardware manufacturer to a consultancy firm and service provider. With this the company sought to enact a form of "global smart city policymaking", using projects and rhetoric that enroll cities into adopting IBM's proposals for smart urbanism (Wiig, 2015, p. 258; Alizadeh, 2017).

However, as Wiig (2016) explains, a city can also use IBM to sell a positive image of itself as an attractive place for private investment, regardless of whether the smart initiative actually solves its intended problem. The smart initiative can, in a way, succeed just by virtue of its discursive power. The question then becomes who does it succeed for and who exerts agency over the initiative? Such questions, we argue, can be better answered if we see the smart city for what it is: a sociotechnical "urban imaginary" (de Waal, 2014).

The success of new sociotechnical imaginaries relies on their fit with existing cultural norms and moral values, social structures and material infrastructure, political institutions and economic systems, hopes and aspirations. Importantly, this process often takes place through the use of narratives, which help render imaginaries as intuitively recognizable, understandable, digestible, and relatable (Hurlbut, 2015; Jasanoff & Kim, 2009; 2015). Not only do narratives seed beliefs, shape understandings, and form associations, they can also be a clarion call that "helps create the political will or public resolve to attain [a sociotechnical imaginary]" (Jasanoff & Kim, 2009, p. 123). At the same time, the circulation of compelling narratives does not guarantee the frictionless propagation of imaginaries.

Like other sociotechnical imaginaries, the smart city is a field of struggle over the political imagination. We should think of these corporate discourses as a tool for directing and delimiting what we can imagine as possible. As this paper shows, IBM and Cisco do not set out a suite of scenarios that represent radically different visions and politics. There are variations to the services they offer, but rarely do they deviate from reflecting and reinforcing the technocratic and neoliberal precepts that motivate this vision of smart urbanism (see also Levenda et al., 2016; Sadowski & Pasquale, 2015). Their aim is to establish *their* version of smartness as *the* future – the only one available or possible. Nonetheless, there are alternative imaginaries that are opposed to the corporate imaginary, which are built on, for example, ideas of urban social justice (McFarlane and Söderström, 2017), urban commons (Borch & Kornberger, 2015), or civic hacking and openness (Townsend, 2013). There is even the rare case of a city like Barcelona, which was a testing ground for Cisco's technology until a radical leftist mayor took office in 2015 and instituted a new vision of the smart city based on initiatives like a "city data commons" and participatory civic platforms (Morozov and Bria, 2018).

Yet, as important as these counter-imaginaries are, they are dwarfed by the scale and influence of IBM and Cisco. The hegemonic mission statement of the corporate imaginary echoes the Thatcherite declaration "There is no alternative." The slogan could also just as well be, "There is no debate." By seeking to dominate the discursive field and capture the imagination of city leaders, IBM and Cisco aim to ensure that alternative smart city imaginaries remain effectively closed off. It follows that if we are to open the space for alternatives and counter-imaginaries, then we need to first understand the principles and attributes of the

dominant imaginary as a way of better knowing what needs to be challenged and how.

Whereas existing discursive analyses of the smart city have focused on specific ideas promoted by corporate initiatives or sought to reveal the neoliberal ideology of their marketing brochures, relatively little attention has been paid to explicating the overarching narrative that forms the foundation of the smart city imaginary. Moreover, while most work focuses on IBM, we also undertook an in-depth analysis and comparison of Cisco in order to demonstrate how multiple major tech companies are simultaneously constructing the same narrative. In this way we hope to augment critical analyses of the technical aspects of the smart city with an analysis of the powerful imaginary by which the smart city is realized. No less important, we hope that by pointing to the incompleteness and indeterminacy of the smart city as a sociotechnical imaginary our analysis will signal that there is still room to intervene in the smart city's development.

Two Companies, One imaginary

Many large corporations and government agencies have staked out their place in the market for smart city systems and services. Projections for the market value of the smart city sector hover around $1 trillion dollars by 2020. While some market research firms are bullish – Frost & Sullivan (2014) projects the value at $1.56 trillion – even conservative forecasts tend to be north of $500 billion (Future Cities Catapult, 2017). However, a small number of firms dominate the sector (Navigant Research, 2016), and at the forefront stand two firms, IBM and Cisco, which have both made a conscious shift towards creating the ways we understand, imagine, and implement smartness. Both of these tech giants pivoted towards smart cities around the same time, doing so years earlier than many of their current competitors. IBM's top executive at the time, Samuel Palmisano, first announced the company's vision for a "Smarter Planet" in a 2008 speech to the Council on Foreign Relations. This program includes a slew of interrelated projects that tack "smarter" onto a range of topics, like water, energy, and electronics. Cisco was not far behind, announcing in 2009 a "holistic blueprint for Intelligent Urbanisation" (which became "Smart+Connected Communities"), similarly tying together different sectors like transportation, security, and government administration (Cisco, 2009).

By leveraging their first-to-market achievements and continuous investment in technological development and marketing, IBM and Cisco have been able to essentially set the terms by which the smart city is promoted and implemented. While they do not have an iron-fisted authority over what smart urbanism means, they wield outsized influence. In the business parlance, IBM and Cisco are well established "thought leaders" of the smart city. Rankings of market size and other metrics consistently put IBM and Cisco at the top. For instance, since at least 2013 Navigant Research, a market analysis and consulting firm focused on

technology trends, has been ranking “smart city suppliers” (Navigant Research 2016). While other companies move around the leaderboard and jockey for positions, IBM and Cisco retain the top two spots. According to Navigant’s criteria, they are the only suppliers categorized as “leaders.” Even as other companies, both small startups and major multinationals, edge into the business of smart urbanism, IBM and Cisco have maintained a dominant position in the market.

Moreover, whether intended or not, IBM and Cisco’s approaches to the smart city tend to be complementary. Whereas IBM focuses heavily on software and consulting services like data analytics and strategic planning, Cisco’s specialty is installing and maintaining hardware like network infrastructure. As Anthony Townsend (2013, p. 63) writes, "If Siemens and Cisco aim to be the electrician and the plumber for smart cities, IBM's ambition is to be their choreographers, superintendent, and oracle rolled into one." Rather than driving each other out of the market, they are able to blissfully coexist.

IBM and Cisco’s status as renowned (and revered) thought leaders is important since the smart city is a world-in-the-making. It exists in a state of temporal suspension: existing in a possible future while being built in the present. Thus, these corporations must simultaneously operate within different temporal contexts, effectively performing the future in the present (Pollock & Williams, 2010; Söderström et al., 2014). As we will see, this causes smart urbanism to contain both reactionary and visionary elements: as a sociotechnical imaginary, the smart city responds to present conditions and entrenches existing political economies while also paving the way to a thriving, prosperous future. In this sense, the smart city represents a wager on the future – a strategic belief that smartness will operate as implied by the smart city sociotechnical imaginary. This could mean buying a suite of smart services from IBM, installing smart infrastructure from Cisco, or handing over an entire district to be developed and run by Sidewalk Labs (a subsidiary of Alphabet Inc.) as is currently happening in Toronto (Bozikovic, 2017).

Given their past and future investments, it stands to reason that IBM and Cisco aim to shape the ways in which smart urbanism is perceived by city leaders (Alizadeh 2017; McNeill 2015). This is often done by producing a wide range of materials that propagate a common discourse. These texts explain core principles, catalog technologies, and pair solutions to problems, but they also lay out a particular narrative about the past, the future, and how to get there. We may say that IBM and Cisco use storytelling to establish themselves as “obligatory passage points” (Callon, 1986; Söderström et al., 2014). In this mode, thinking about the smart city and implementing the smart city vision requires relevant actors to adopt IBM and/or Cisco’s concepts, frameworks, and solutions.

A Note on Method

This article reports on the results of a grounded theoretical analysis of IBM and Cisco's large corpus of discursive material (Strauss & Corbin, 1998). It consists of over 75 documents, including public speeches, white papers, technical reports, "solutions briefs," "point of view papers," financial reports, websites, magazine essays, promotional marketing, and advertisements. In an attempt to be complete, as many documents as possible were gathered by downloading everything from each company's website, using targeted web searches, collecting documents from third-party partners (e.g. Frost & Sullivan), and relying on the Internet Archive to recover websites and documents that were changed or deleted. After gathering the corpus of material, each document was read closely, memoed, and coded for themes, concepts, and categories. Once the coding system was developed, major documents were re-analyzed (e.g. programmatic frameworks and core reports) to ensure useful data was not overlooked (Ryan & Bernard, 2003). The data about IBM and Cisco was analyzed separately and then together. While there are certainly differences in terminology, concepts, and initiatives between the two firms, as reflected in the following analysis, we found that they closely fit into the same overarching narrative. Methodologically, we rely on discourse analysis because documents are the medium most often used to construct and transmit sociotechnical imaginaries (see Levenda et al. 2018; Tidwell and Smith 2015). Sociotechnical imaginaries "reside in the reservoir of norms and discourses" (Jasanoff and Kim 2009, p. 123) and that is where we directed our analysis of smart urbanism.

As became clear during the analysis, the documents produced by IBM and Cisco are not just examples of corporate marketing or technical reports; they also detail the features of a future they hope to build. In other words, these two projects – IBM's "Smarter City" and Cisco's "Smart+Connected Communities" – weave a complex story about the technological salvation of the city. The narrative begins with crises, the catastrophes that cities will inevitably face now and in the near future. Then we are provided with theories that outline how cities may be transformed into smart places that stand strong and thrive. Next we are told about the smart solutions that provide the interventions, systems, and services for real change. Finally, we encounter different implementation strategies that ensure the smart city will be actualized. We discuss these four elements in turn.

Crisis as Catalyst

The story of the smart city imaginary begins by establishing that we – as a society, as urban citizens, as city leaders – are confronted with a number of daunting problems and crises. They threaten our very way of life, forcing us to discover new ways of doing things as the old ways become obsolete and insufficient. As Cisco says, "Cities and communities around the world face intractable challenges," including population increase and rapid urbanization that

place “massive pressure on city infrastructures,” the continuation of austerity budgets that cause cities to be “limited in their ability to respond to these pressures,” and the catastrophes promised by climate change, “forcing cities to develop sustainability strategies” (Falconer & Mitchell, 2012, p. 2). For both Cisco and IBM, crisis is certain; it is just a matter of when it will strike. At stake is nothing less than the fate of the world: “It’s clear now that the future of cities is the future of the planet. So it’s essential that solutions be found” (IBM, 2013, p. 2).

Naturally, preparation for crises, perceived or actual, is crucial. According to IBM’s manifesto, “A Vision of Smarter Cities” (Dirks & Keeling 2009, p. 3), “Cities face a range of challenges and threats to their sustainability across all their core systems that they need to address holistically”. Nonetheless, a crisis is also a chance to “seize opportunities and build sustainable prosperity by becoming smarter” (ibid.) No city, rich or poor, can escape the need for smart restructuring. “In both mature and emerging markets,” says a consulting report sponsored by Cisco, “city authorities are facing a number of significant challenges” (Green, 2011, p. 1). At the core of the smart city sociotechnical imaginary, then, lies the belief that, “Faced with an increasingly unpredictable and hazardous future the smartest cities will be those which best prepare for imminent insecurity” (White, 2016, p. 574). Such insecurity is often represented as three different types of crisis: rapid urbanization, fiscal austerity, and climatic catastrophe.

The idea that human society has entered the “urban age” – that is, over half of the world’s population lives in cities – is a common truism (Brenner & Schmid, 2013). “We should be proud of this unprecedented urbanization,” IBM’s Samuel Palmisano (2010, np) writes, “But it is also a huge strain on the planet's infrastructure.” Similarly, Cisco deems our current epoch the “urban century” (Hodgkinson, 2011). At the same time, the rise of urbanity signals an impending overpopulation crisis, and cities are warned about the intense strain this may have on services and infrastructure. If cities are going to survive and thrive in spite of this pressure, then the entire urban “system of systems” – transportation, buildings, water, power, public safety, emergency responses, and more – must eventually be redesigned and made smart(er) so it can sustain growth.

Additionally, cities everywhere must grapple with the economic realities of fiscal austerity and fierce competition. As Cisco establishes, “fragilities in the global financial system threaten to stall, if not reverse, years of economic progress” (Evans, 2012, p. 1). The financial crash in 2008, adds IBM, has “ushered in a systemic and prolonged economic adjustment that has severely crippled the ability of governments to deliver expected services to citizens, let alone push for innovative, new services” (IBM, 2012, p. 1). Meeting increased demands and managing austerity will require instituting new forms of smart urban governance that allow cities to “do more with less” by embracing “force multipliers” like data-driven systems and public-private partnerships, while also improving security,

safety, and stability to create good business climates. In this sense, smart urbanism promises shelter from financial uncertainty.

The third crisis faced by cities involves environmental disasters brought about by climate change and unsustainable practices. Cisco sets the scene by matter-of-factly pointing out that "rapid climate change, regardless of the cause, threatens our way of life by impacting the weather, agriculture, and much more" (Evans, 2012, p. 1). What's more, cities are "uniquely vulnerable to the consequences of climate change," which puts their populations, their infrastructure, and their prosperity at further risk (Green, 2011, p. 10). It is unsurprising, then, that the smart city sociotechnical imaginary incorporates notions of sustainability, leveraging climate change to argue that the smart city is much more sustainable than the non-smart city. "This approach," says IBM, "recognizes that information provides one of the greatest opportunities for making the planet smarter, and becoming smarter leads to new ideas, efficiencies, and equally important, new possibilities for our planet's sustainability" (Biciocchi & Phillips, 2015, p. 3). Furthermore, since climate change is a crisis of global scale, it requires building what IBM calls a "smarter planet." Smartness, therefore, allows cities to adapt and respond to the Anthropocene.

Given this overall crisis-based framing we can read the smart city as a reactionary story, and not only the ultimate manifestation of techno-utopian thought. To be sure, those utopian elements are still present, especially in the dreamscapes of smart cities that are built from scratch on empty plots, networked and sensored from the outset. Yet, when we consider the smart city as a piecemeal project of securing against an impending catastrophic future, it begins to take shape as a conservative project in which the best course of action is to pragmatically maintain stability and to technically control uncertainty (Leszczynski, 2016). "In this way, response to extreme and exceptional events—such as are imagined to be brought on by weather shifts and domestic insecurity—might be efficiently managed, and the city quickly returned to a state of normalcy" (White, 2016, p. 582).

Technological Transformations

The many crises faced by cities – and the choices made about which ones to marshal and what elements to emphasize – are the backdrop for the real descriptive and prescriptive work of the smart city imaginary. Insofar as "efforts to build new sociotechnical futures are typically grounded in positive visions of social progress" (Jasanoff, 2015a, p.4), the work of establishing and stoking crises serves to precipitate demand for frameworks that can be used for guiding change (Pfotenhauer & Jasanoff, 2017). In our reading, this is precisely the modus operandi of IBM and Cisco. Both companies lay out largely cohesive, and often overlapping, frameworks for urban transformation. They rearticulate cities as places in need of smart systems. Framing both the principles and practices of

smart urbanism as ready-made panaceas for urban problems, IBM and Cisco promote the embedding of the smart city imaginary in municipal institutions.

Both companies mobilize a theory of the city as a "system of systems" (IBM) or a "network of networks" (Cisco) – a theory that is meant to describe how cities exist, how they are knowable, and how their infrastructures and services operate. Each company then fleshes out a prescriptive framework of how to design, deploy, and actualize the smart city. For IBM it is the three I's of instrumentation, interconnection, and intelligence. For Cisco it is the Internet of Everything (IoE). These frameworks are the foundation for much of IBM and Cisco's model of smart urbanism. They turn the city into a single smart assemblage and form a crucial element of the smart city imaginary.

In a 2011 speech entitled "Smarter Cities: Crucibles of Progress," IBM's Sam Palmisano said, "Smarter city leaders think in terms of systems. When you understand that the world has become pervasively instrumented and interconnected it inevitably leads you to see our planet not as a collection of countries or industries, but as a system of systems." For IBM, transforming cities into their smarter incarnations requires a suite of new technologies that render the city's core systems instrumented, interconnected, and intelligent. Each of the three I's represents a layer of technologies and services that build on top of each other. The bottom layer, instrumentation, is "made up of sensors, actuators, programmable logic controllers, and distributed intelligent sensors" (Kehoe et al., 2011, p. 11). The main purpose is "data capture and control" by turning the city into a source of endlessly flowing streams of data (Ibid., p. 12). The middle layer, interconnection, clusters and integrates the city's systems by embedding computational power into a variety of objects that are then linked into a vast network. Through this process commands can be sent anywhere and different data sources can be fused, allowing managers "to monitor the [city] domain effectively" (Ibid., p. 12). The top layer, intelligence, then uses analytics to make sense of the data produced from the networked systems. The analyzed data can then be used to create performance dashboards, control interfaces, and other urban software applications. When the three levels are optimized, argues IBM, the smart city unlocks competitive advantage, creates value, and enhances "economic vitality" (Fleming et al., 2015).

Cisco's framework is an explicit expansion of the ongoing technological trend known as the Internet of Things (IoT), in which physical objects, ranging from household appliances to industrial machinery, are embedded with sensors and computation so they can collect, communicate, and analyze information through the Internet. Cisco positions the Internet of Everything (IoE) as more than just a new term for an existing "phase" or "era." Rather, the IoE is described as a transformative evolution in technological progress in which "billions or even trillions of connections create unprecedented opportunities as well as new risks" (Mitchell et al., 2013, p. 12). The IoE incorporates four components: people, data, things, and process. First, people will connect not just through device interfaces,

but also with wearables, implantables, and simply by inhabiting sensored environments. They will become nodes on the Internet, like "a constantly emitting activity system" (Evans, 2012, p. 3). Second, data will no longer be simply gathered and streamed to a central source for processing, but instead will be turned into "information" through constant accumulation, real-time analysis, and fusion of multiple sources. Third, things in the IoE "will sense more data, become context-aware, and provide more experiential information to help people and machines make more relevant and valuable decisions" (Ibid., p. 4). Fourth, process works to ensure the other three components make relevant connections, enhance intelligence, and create value.

For tech corporations and city leaders, the sociotechnical imaginary of smart urbanism promises control over a myriad urban dynamics, and then outlines ways to make that dream come true. By embracing the IoE and a network of networks view – or, for IBM, the three I's and a "system of systems" view – the city ceases to be a messy, unknowable, and uncontrollable place. Urban elites can imagine themselves possessing a panoptical power, similar to the way Sherlock Holmes describes his nemesis, the mastermind Moriarty: "He sits motionless, like a spider in the centre of its web, but that web has a thousand radiations, and he knows well every quiver of each of them" (Doyle, 2012, np). The framework proffered by IBM and Cisco reimagines – and seeks to recreate – the city as a smart technological web with tech corporations and city leaders sitting at its center.

Smart Solutions

The way IBM and Cisco theorize the smart city is scarcely a description of how cities exist. It establishes the foundation for "smart solutions" that lead to control of the city, optimization of its operations, and extraction of value (Sadowski & Pasquale, 2015; Vanolo, 2014). The goal of the technologies, services, and policies that make up the smart city is to transform the city into a "platform" for the integrated ICTs and governance models provided by the tech corporations.

It is important to recognize that the language of "solutions" – like that of "smartness" – is more than just a puerile label. "These aren't harmless verbal frames," explains Ian Bogost (2015, np). "They are signs of our willingness to allow a certain kind of technological thinking to take over all other thinking" (ibid.) Decisions over terminology tell us something important about how Silicon Valley frames the world. At the core is a deeply held "solutionism" (Morozov, 2013): the belief that all the world's problems, even those that should not be thought of as problems in the first place, can be solved technologically. By recasting everything as a problem waiting for a techno-fix, especially issues that are social in nature, the space for philosophical reflection and political contention shrinks. Furthermore, in effect, the solutionist language works backward: for those in the

business of providing solutions, solvable problems are essential. The crises are tailored to justify the solutions, and the latter come in different forms and guises.

Perhaps the most popular image of a smart city solution is the control room (Luque-Ayala & Marvin, 2016). Control rooms have been installed in a range of places – from Camden, New Jersey (Wiig, 2017) to Rio de Janeiro, Brazil (Gaffney & Robertson, 2016) – because they promise to enact the smart city in a very real, impactful way. These control rooms typically contain rows of computer terminals and workstations occupied by city managers, data analysts, and/or police dispatchers, all facing a wall-sized grid of screens. Cisco has called these centers the "brain" or "engine" of the smart city (Cisco, 2014b, p. 3), and IBM adds that control rooms help "transform raw data – collected from sensors located across the city, historical databases, existing applications and other sources – into actionable insights" (IBM, 2011, p. 7). Insofar as the smart city imaginary is reinforced through a story of crisis and preservation, the control room embodies the very possibility of salvation.

If the flesh of the smart city is its physical infrastructure, and its nerves the networks that pass information from street to control room, its lifeblood is data. Many of the smart city solutions promoted by IBM and Cisco are based on creating, collecting, processing, and using data. The prevailing attitude is based on an imperative to extract all data, from all sources, by any means possible (Fourcade & Healy, 2016). It has created an arms race for data, fueling the creation of surveillance technologies that infiltrate all aspects of the urban environment and city life. According to a Cisco report, "Smart City technologies integrate and analyze massive amounts of data to anticipate, mitigate, and even prevent many problems" (Clarke, 2013, p. 1). Much of this data has immediate application in areas such as traffic management, predictive policing, and environmental sensing. However, the unending accumulation of data is also based on the speculation about the value data might generate in some undisclosed future for some imagined purpose. IBM's Palmisano (2010, np) acknowledges that the barrage of data may be overwhelming, but he quickly dismisses such concerns: "You may be thinking that the last thing we need is more information raining down on us, more noise. But we now have the capability, with advanced software analytic tools, to extract value from data—to see the patterns, the correlations and the outliers." For the leading imagineers of the smart city, if data can be collected, then it must be. Big data is never big enough.

Implementing Initiatives

Making smartness a reality – a physical thing in the world – requires using a plurality of methods. The implementation process is shaped by aspects such as the local context and social/material structures of the target city, the challenges and desires that motivate city leaders, and the profitability and feasibility for tech

corporations. As important as the visions, theories, and frameworks of smartness are, the ultimate goal is to leverage the smart city imaginary into concrete technological commodities.

Cisco admonishes other stakeholders for lagging behind on the "how" phase of smart cities. While urban experts and academics spend a considerable amount of time thinking about "why," and tech companies and consultants focus on "what," city leaders need the most assistance with "how." Cisco concludes that, "The debate is no longer about why a Smart City initiative is good for a city or what to do (which available options to choose), but instead about how to implement Smart City infrastructures and services, including the importance of a common language and a structured approach to implementation" (Falconer & Mitchell, 2012, p. 9; emphasis in original). This is a strong declaration: The black box has closed, and the smart city imaginary has emerged victorious. Cisco admits that both types of questions – "why" and "how" – "are important, but focusing too much on the 'why' will hinder quick adoption of solutions and initiatives" (ibid.) Urgent demands to innovate and iterate are based in an anxiety to realise the promised potential of the smart city. Yet, the world is not a blank slate, there are existing policies, materialities, and structures that the smart city must plug into or work around (Selin and Sadowski, 2016). This means that implementation strategies vary place by place. We identify three broad styles of implementing the smart city.

By far the most common "actually existing" smart cities are those that are retrofitted and renovated with upgrades that transition them from "dumb" to "smart". This usually starts with one or a few initiatives meant to address a specific problem, such as parking or public safety. In these cases, "the smart city is assembled piecemeal, integrated awkwardly into existing configurations of urban governance and the built environment" (Shelton et al., 2015, p. 15). A Cisco report calls this process "digital urban renewal" (Green, 2011, p. 6). Rather than stripping out "legacy systems" and replacing them with smart updates, many retrofits involve the "use of ICT as an overlay for existing infrastructure" and incremental changes to current institutions (Ibid., p. 7).

Then there is the 'shock therapy' method of implementation – or, what we call smart shock – in which a city undergoes a quick, large-scale integration of smart urbanism ideals, technologies, and policies into an existing landscape. In these cases, the smart city transition happens to a greater degree and over a short time period. Smart shocks are much rarer than retrofits because they require much more financial and political capital. It is unsurprising, then, that those cities that have undergone a smart shock tend to make smartness a central part of their identity, perhaps to justify the large expenditure. They also tend to receive more attention from scholars and journalists since the operations and impacts of smartness are more apparent and contentious. An example of a smart shock is Rio de Janeiro, Brazil. In 2010, Rio partnered with IBM to install the Rio Operations Center, which drew together data from 30 different agencies and

centralized city management. The city also installed an Integrated Center of Command and Control, which serves as the headquarters for general security planning and Rio's Police Pacification Units. These control centers were installed in advance of two mega-events in Rio: the 2014 FIFA World Cup and the 2016 Olympics (Gaffney & Robertson, 2016).

Perhaps the most idealistic models for the smart city are built from scratch projects that are being constructed where nothing existed before. A canonical case is New Songdo in South Korea, which serves as a global test-bed (Halpern et al., 2013) and urban laboratory (Cardullo et al., 2017) for implementing large-scale smart systems "in the wild." Even the island it is being constructed on is human-made, truly allowing it to be a city from nowhere. The built-from-scratch method of implementation seeks to realize a zone of futurity, like a living exhibition of our grand urban future. However, none of these cities have yet to be fully brought online. "Building new, green cities from scratch is a great way to showcase potential solutions, but most people will never live in this kind of development," Cisco recognizes (Green, 2011, p. 1). These model cities are more like showcases for the technology's potential: why just tell customers about the smart city with a pamphlet, when you can show them the imaginary in tangible form?

Conclusion

In this article, we have described how the smart city narrative is structured: stoke a crisis (or three), theorize a framework for transforming the city, marshal solutions to fix what ails city-clients, and strategize about different implementation styles. The narrative shows how IBM and Cisco sell the smart city as both a reactionary and visionary force. In this model, smart urbanism is not just a collection of discrete ideas and initiatives but a coherent vision with motivations and goals. It plots out a near future, but one that largely reproduces and maintains existing socio-political systems (Leszczynski, 2016; Pollio, 2016; Wiig, 2017). The narrative of the future provides an overarching structure and a vehicle for delivering this model of smart urbanism to city leaders.

As of 2013, Rometty said that IBM has been involved in "more than 2,000 Smarter Cities engagements," in which IBM has helped "mayors and other urban leaders manage, analyze and use data for economic growth, increased profitability and the public good" (Rometty, 2013a, np). A more recent report from Cisco boasts the company has "deployed solutions in many cities worldwide – some 120 deployments of varying sizes" (Cisco, 2014a, p. 3). Places such as Copenhagen, Chicago, and Dubai serve as "lighthouse cities" that signal the paths for other smartness-seeking cities. The smart city movement has spread quite successfully so far and it is still growing. With that said, we should be cautious about over-emphasizing IBM's and Cisco's capacity to successfully propagate their smart city imaginary and dominate the smart city discourse. As

Shelton et al. (2014, p. 14) warn, there is a "tendency within critical accounts to see the smart city as a kind of universal, rational, and depoliticized project that largely plays out according to the terms of profit-maximising, multinational technology companies." The corporatized model of the smart city, in other words, must be recognized for its contingency. So even if IBM and Cisco were able to establish their version of smartness as hegemonic – indeed, other than the corporate model "there exist no large-scale alternative smart city models" (Hollands, 2015, p. 70) – this isn't to say there are no alternatives, only that they are still struggling to compete with the corporate imaginary. With the risk of technological momentum (Hughes, 1994) and technological lock-in, there is an obligation for critical scholarship to analyze the features and confront the influence of the corporate imaginary.

In doing so, future research must resist the temptation to assume that the smart city will work or be materialized in exactly the way the corporate imaginary lays out. As the smart city imaginary is actualized, it will be important to pay attention to places where divergence, breakdown, and resistance happen (Bulkeley et al. 2016; Hoyng 2016). Doing so will help shed light on the material politics and ontology of the smart city, while also revealing cracks in its foundation. Furthermore, future research should also trace the movement from corporate imaginaries to real cities by analyzing city governments, leaders, and planners in terms of both their own perception of the smart city and their process of actualizing the smart city (Alizadeh 2017; Wiig 2015). How do specific, actually existing cities reproduce and differ from IBM and Cisco's imaginary of the smart city? What characteristics of the city influence how the imaginary is enacted? What processes, people, and power dynamics are involved in attempts to make a city smart?

The smart city is a dynamic future-in-the-making. While it is true that the corporate model is an offshoot of a deeply rooted political economic regime, we must not mistake a contingency for inevitability, despite IBM and Cisco's efforts. In this vein, reframing and reimagining smart urbanism must involve creating counter-narratives that open up space for alternative values, designs, and models (Kitchin, 2016; March, 2016). Doing so requires understanding the existing narrative's tenets and characteristics – "attending to the means by which imaginaries frame and represent alternative futures, link past and future times, enable or restrict actions in space, and naturalize ways of thinking about possible worlds" (Jasanoff, 2015a, p. 24) – as a way of better knowing what needs to be challenged and how.

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