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Welcome to the Metropticon: Protecting Privacy in a Hyperconnected Town

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WELCOME TO THE METROPTICON: PROTECTING PRIVACY IN A HYPERCONNECTED TOWN

Kelsey Finch and Omer Tene[*]

INTRODUCTION

Over half a century ago, Jane Jacobs sparked a revolution in urban planning with her 1961 book *The Death and Life of Great American Cities*, challenging the first wave of progressive urban renewal

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policies for failing to respect the needs and diversity of city-dwellers.[1] The urban redevelopment projects against which Jacobs fought aspired to revitalize and modernize U.S. cities in the postwar era, but failed to produce concrete results.[2] Ultimately, they collapsed under the weight of their own mixed performances and the vocal criticism of social reformers; their legacy lingers in "[a]rtists' renderings of slick glass and steel skyscrapers set in sunny plazas . . . nurtur[ing] hopes of a golden future."[3]   For all of their high hopes, diverse and multitudinous supporters, technological promise, and intelligent planning systems, the first wave of urban renewal programs have gone down in history as "planning panaceas."[4]

Today, once again a diverse array of urban planners, businesses, technologists, academics, governments, and consumers have begun to join their voices in support of the newest revolution in urban planning: the smart city. Driven by the technological promise of the Internet of Things (the increasing array of objects and devices that communicate with each other over the network) and the intelligent planning systems of big data (the enhanced ability to collect, store, and process massive troves of information), smart city initiatives are equally, if not more, disruptive to the urban existence of today as slum-clearing urban renewal efforts were in the previous century. Smart city technologies thrive on constant, omnipresent data flows captured by cameras and sensors placed throughout the urban landscape. These devices pick up all sorts of behaviors, which can now be cheaply aggregated, stored, and analyzed to draw personal conclusions about city dwellers.[5]   This ubiquitous surveillance threatens to upset the balance of power between city governments and city residents, and to destroy the sense of privacy and urban anonymity that has defined urban life over the past century.[6]

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1. *See* Jane Jacobs, The Death and Life of Great American Cities (1961).

2. *See* Jon C. Teaford, *Urban Renewal and Its Aftermath*, 11 HOUSING POL'Y DEBATE 443, 443–44, 445–51 (2000), *available at* http://content.knowledgeplex.org/kp2/img/cache/kp/2092.pdf.

3. *Id.*

4. *Id.*

5. Quentin Hardy, *How Urban Anonymity Disappears When All Data Is Tracked,* N.Y. TIMES BITS BLOG (Apr. 19, 2014, 7:00 AM), http://bits.blogs.nytimes.com/2014/04/19/how-urban-anonymity-disappears-when-all-data-is-tracked.

6. As Jane Jacobs wrote in 1961, "[c]ities are, by definition, full of strangers." Jacobs, *supra* note 1; *see also* GHENT URBAN STUDIES TEAM, THE URBAN CONDITION: SPACE, COMMUNITY, AND SELF IN THE CONTEMPORARY METROPOLIS (1999).

Although privacy advocates may yet stand in for Jane Jacobs and other social reformers in this modern urban planning debate, it is far from clear that smart cities are mere panaceas. Smart cities bring cutting-edge monitoring, big data analysis, and innovative management technologies to the world of urban planning, promising to make cities "more livable, more efficient, more sustainable, and perhaps more democratic."[7] Of course, "clever cities will not necessarily be better ones."[8] There is a real risk that, rather than standing as "paragons of democracy, they could turn into electronic panopticons in which everybody is constantly watched."[9] They are vulnerable to attack by malicious hackers or malfunction in their complex systems and software, and they furnish new ways to exclude the poor and covertly discriminate against protected classes.

This Article asks whether the compelling benefits of ubiquitous data collection can be squared with privacy concerns, whether our future cities will evolve into dystopian urban panopticons or into utopian spaces without crime, pollution, or over-crowding. Part I of the Article describes the benefits and promises of data-driven, hyperconnected smart cities, including technologies to navigate and traverse urban spaces and cultures, as well as more efficient and eco-friendly smart infrastructure systems. Part II describes some of the privacy risks and challenges attendant with bringing big data and ubiquitous sensors to every public—and private—space, including normalizing surveillance, institutional paternalism, increasingly intrusive monitoring, data overload, and discrimination. Part III argues for smart systems to be developed without becoming systems of mass surveillance. It calls for big data privacy solutions such as access rights and data featurization, de-identification, and enhanced transparency to be deployed via both law and technology.

I. Smart City Innovation: Urban Utopia

Since their earliest days, cities have been imbued with a sense of progress and promise. Today, they are home to the newest trends and technologies, capable of driving national agendas and discussions on their own. Cities, at their best, are "hubs of human connection,

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7. *Clever Cities: The Multiplexed Metropolis*, Economist, Sept. 7, 2013, *available at* http://www.economist.com/news/briefing/21585002-enthusiasts-think-data-services-can-change-cities-century-much-electricity.

8. *Id.*

9. *Id.*

fountains of creativity, and exemplars of green living."[10]   At their worst, "they still suffer the symptoms of industrial urbanization: pollution, crowding, crime, social fragmentation, and dehumanization."[11]   Smart cities, however, promise to ameliorate these frictions of urban life, optimizing services to cater to individual needs and preferences and furnishing real-time solutions to the hardships and inconveniences of city life. Moreover, they promise to usher city-dwellers into a new era of tech-driven efficiency and equality.

A. Finding Yourself

In today's sprawling metropolises, no matter how carefully planned (or how organically chaotic) the streets are arrayed, it is easy to get lost. While being stuck on the wrong side of a subway platform or struggling to navigate confusing, unmarked side-streets is perhaps the most common form of losing yourself in a city, the urban "culture of inattention" creates social and cultural divides that can leave city-dwellers equally lost, living in a city "full of strangers."[12]

Smart city technologies, however, have begun to provide both physical and cultural maps to help direct the lost, as well as the merely curious, towards a greater understanding of where things (and people, and events, and resources) are in the city.[13]   For example, those simply trying to figure out how to get from point A to Z can now use comprehensive transit apps like Citymapper, which won the New York MTA's 2013 App Quest Competition for integrating location services with "real-time data and [for] its ability to track multiple forms of New York's transit. This includes subways, busses, and even the newly-introduced Citibikes."[14]   Other contestants sought to use location services to highlight and increase the accessibility of city life's more sociable aspects, such as an app that "matched people with their favorite subway musicians."[15]

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10. CITY 2.0: THE HABITAT OF THE FUTURE AND HOW TO GET THERE 7 (Ted Books ed. 2013) *available at* http://hdl.handle.net/10161/6772.

11. *Id.*

12. *See* GHENT URBAN STUDIES TEAM, *supra* note 6, at 127.

13. *See* Sarah Kessler, *App Quest Contest Challenges Developers to Create Apps Using NYC Data*, MASHABLE (July 12, 2011), http://mashable.com/2011/07/12/mta-app-contest/.

14. Cale Guthrie Weissman, *Citymapper Wins Big at New York's MTA App Quest Competition*, PANDODAILY (Sept. 24, 2013), http://pando.com/2013/09/24/citymapper-wins-big-at-new-yorks-mta-app-quest-competition/.

15. *Id.*

On the other end of the spectrum, the ready availability of public data, social media, and machine learning software helps academics, advocates, and urban planners better study "the dynamics, structure, and character of a city on a large scale."[16] By compiling and analyzing public tweets and social check-ins at locations around the city, the Livehoods Project, for example, explores "how people actually use the city, simultaneously shedding light onto the factors that come together to shape the urban landscape and the social texture of city life, including municipal borders, demographics, economic development, resources, geography, and planning."[17] By mapping and aggregating actual route data and destination activities of city-dwellers, Livehoods captures the character of dynamic urban neighborhoods, defined "not just by the types of places found there, but also by the people who choose to make that area part of their daily li[ves]."[18] It teaches us, for example, that individuals who check-in in New York's Upper West Side (number one location: Whole Foods) also tend to travel to midtown (for work) or downtown (for play) but seldom to the Upper East; while Chelsea check-ins (think Chelsea Market and wine shops) also frequent the Lower East Side and the East Village.[19]

B. Getting Around

The success and promise of smart technology and infrastructure in cities is evident in the ever-expanding range of new urban transportation services, which not only use ubiquitous technology and sensors to streamline public transit but have also sparked responsive, data-driven private alternatives.[20] Through the efforts of both diligent city planners and "DIY urbanism," subways, buses, cars, taxis, bicycles, sidewalks, parking spaces, tolls, traffic, and road construction, conditions and improvements can all be monitored and optimized in real time, saving businesses, residents, and governments

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16. *About the Livehoods Project*, LIVEHOODS PROJECT, http://livehoods.org/about (last visited Oct. 18, 2014).

17. *Id.*

18. Justin Cranshaw et al., *The Livehoods Project: Utilizing Social Media to Understand the Dynamics of a City*, INT'L AAAI ON WEBLOGS & SOC. MEDIA (May 20, 2012), https://www.aaai.org/ocs/index.php/ICWSM/ICWSM12/paper/view/4682/4967.

19. *See generally*, LIVEHOODS PROJECT, *supra* note 16.

20. ANTHONY M. TOWNSEND, SMART CITIES: BIG DATA, CIVIC HACKERS, AND THE QUEST FOR A NEW UTOPIA 162–63 (2013).

significant time and money while better ensuring millions of people can get to where they need to go.[21]

While many city-dwellers scoff at even a data-driven public transit commute, data-driven *private* transit opportunities are also beginning to sprout. In addition to app-based taxi-substitute services like Lyft or Uber, urbanites are now offered premium-priced "pop-up" bus services. One such bus service, Bridj, "collects millions of bits of data about people's commutes from Google Earth, Facebook, Foursquare, Twitter, LinkedIn, the census, municipal records and other sources" in order to design dynamic bus routes, using technology to make transit even more efficient.[22] Other data-driven bus services can target specific demographics and tailor routes to their needs, such as BreakShuttle, "which takes college students back home during school breaks."[23]

More prosaically, but also more importantly for car-owning residents or visitors to modern cities, parking and toll alert and payment systems dramatically reduce the daily frustration of parking in the city.[24] Electronic toll collection systems have become the norm in both urban and non-urban spaces, using RFID tags and video cameras so that drivers can prepay tolls, eliminating the need to stop at toll plazas.[25] These passes, reporters discovered, have also been tracked *within* city limits ostensibly to provide real-time traffic information to city transportation departments.[26] License plate recognition technology is similarly redeployed; companies like *LocoMobi* advertise that their gear can photograph and identify the license plates of incoming and outgoing cars, using cloud computing systems to calculate how long a car was parked and apply the

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21. Sommer Mathis, *The Rise and Fall and Eventual Rise Again of the 'Smart City'*, CITYLAB (Jan. 13, 2014), http://www.citylab.com/tech/2014/01/rise-and-fall-and-eventual-rise-again-smart-city/8081.

22. Katharine Q. Seelye, *To Lure Bostonians, New 'Pop-Up' Bus Service Learns Riders' Rhythms*, N.Y. TIMES, June 4, 2014, http://www.nytimes.com/2014/06/05/us/to-lure-bostonians-new-pop-up-bus-service-learns-riders-rhythms.html; *see* Christopher DeMorro, *Pop-up Bus Service Crowdsources Data For Better Routes*, CLEAN TECHNICA (June 9, 2014) http://cleantechnica.com/2014/06/09/pop-bus-service-crowdsources-data-better-routes.

23. DeMorro, *supra* note 22.

24. *See Smart Parking Could Relieve Congestion, Says Beecham Research*, FLEET NEWS (Mar. 28, 2014), http://www.fleetnews.co.uk/news/2014/3/28/smart-parking-could-relieve-congestion-says-beecham-research/50023/.

25. *See, Overview*, E-ZPASS N.Y., https://www.e-zpassny.com/en/about/about.shtml (last visited Oct. 18, 2014).

26. Kashmir Hill, *E-ZPasses Get Read All Over New York (Not Just At Toll Booths)*, FORBES, (Sept. 12, 2013), http://www.forbes.com/sites/kashmirhill/2013/09/12/e-zpasses-get-read-all-over-new-york-not-just-at-toll-booths.

charge.[27]   According to the company's co-founder, the technology might someday be tied "to a car's navigation system, enabling drivers to find and reserve nearby parking spots without wasteful driving."[28]

Of course, some say that one of the smart city's most iconic technologies, the smart car, may do away with the need for pop-up buses or parking apps entirely.[29] Although researchers predict that by 2050 nearly all cars will be self-driving, that technology currently remains in its earliest practical stages.[30]   This has not stopped journalists, or anyone else, from dreaming of all the ways these cars could make cities cleaner, greener, more accessible, more efficient, and simply more pleasant to live in. In a world of self-driving cars, we can imagine that "Inner-city parking lots could become parks. Traffic lights could be less common because hidden sensors in cars and streets coordinate traffic . . . [a]nd the air would be cleaner because people would drive less."[31]   While driverless cars may not yet be a reality, their promise directly complements utopic visions of future smart cities.

C. Keeping the Lights On

Although innovative technologies and new service models springing up in connected cities draw the most media attention, the success of smart cities is more significantly defined by dynamic, data-driven infrastructure systems, such as smart grids. Infrastructure systems keep a city's lights on and its water flowing, and provide the other basic services necessary to make a city livable and sustainable.[32] The density of urban populations puts significant strain on these systems, especially 'dumb' static systems that may be pushed to their limits by unexpected changes in load or demand.[33] Accessible digital

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27. Hardy, *supra* note 5.

28. *Id.*

29. *See, e.g.*, Thilo Koslowski, *Forget the Internet of Things: Here Comes the 'Internet of Cars'*, WIRED (Jan. 4, 2013), http://www.wired.com/2013/01/forget-the-internet-of-things-here-comes-the-internet-of-cars.

30. Chris Woodyard, *Study: Self-Driving Car Sales Will Explode*, USA TODAY, (Jan. 2, 2014, 7:37 PM), http://www.usatoday.com/story/money/cars/2014/01/02/self-driving-study/4292893.

31. Nick Bilton, *Disruptions: How Driverless Cars Could Reshape Cities*, N.Y. TIMES BITS BLOG (July 7, 2013, 11:00 AM), http://bits.blogs.nytimes.com/2013/07/07/disruptions-how-driverless-cars-could-reshape-cities.

32. *See* Chris Ling et al., *What Makes a City Liveable?*, CRC RES. (Dec. 19, 2006), http://crcresearch.org/case-studies/case-studies-sustainable-infrastructure/land-use-planning/what-makes-a-city-liveable.

33. *See, e.g.*, BRETT M. FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES (2013).

sensors, advanced communications networks, and sophisticated analytics allow local governments—as well as businesses, researchers, and residents—to better allocate resources, respond to emergencies, and proactively address many challenges of industrial urbanization, such as traffic, energy, water, education, unemployment, health, and crime management.[34]

One of the most visible "smart" infrastructure systems today is the smart grid, which allows utilities, users, and other third parties to monitor and control electricity use.[35] Consumers report seeing immediate benefits from smart meters in their homes or businesses, instantly gaining more control and choice over the means, timing, and quantity of electricity they use.[36] Access to real-time, localized energy consumption data through smart meters enhances the efficiency of urban electric grids, allowing utilities to more accurately predict demand, locate power outages or other problems, resolve issues, and ensure the stability and safety of the grid.[37] In addition to the short-term cost and efficiency benefits, pro-environment policymakers view the smart grid as key to providing better power quality and more efficient delivery of electricity to facilitate the move towards renewable energy.[38] Other benefits, such as accurately predicting energy demands to optimize renewable sources, may also accrue to society at large.[39]

Other, less obvious technologies—like sensor-enabled trash cans that could sort recycling automatically[40] or alert crews that it is time for a pick-up[41]—may also become forces for stimulating green living in urban spaces. In fact, waste management is a significant challenge for modern cities; shared, sensor-equipped infrastructure could help

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34. Charith Perera et al., *Sensing as a Service Model for Smart Cities Supported by Internet of Things*, 25 TRANSACTIONS ON EMERGING TELECOMM. TECHS. 81, 89 (2014) http://onlinelibrary.wiley.com/doi/10.1002/ett.2704/pdf.

35. *See Smart Grid*, ENERGY.GOV, http://energy.gov/oe/services/technology-development/smart-grid (last visited June 30, 2014).

36. Future of Privacy Forum, Consumer Generated and Controlled Health Data, Comments Before the Federal Trade Commission (2014), http://www.futureofprivacy.org/wp-content/uploads/FPF-Comments-to-FTC-on-CGHD.pdf.

37. *Id.*

38. *Id.*

39. *Id.*

40. Darren Quick, *'Smart Trash' Cash for Recycling Concept*, GIZMAG (Nov. 2, 2009), http://www.gizmag.com/smart-trash-recycling/13254/.

41. Jesse Berst, *Smart Cities, Data Collection and Privacy: Getting It Right*, SMART CITIES COUNCIL (Apr. 9, 2014), http://smartcitiescouncil.com/article/smart-cities-data-collection-and-privacy-getting-it-right.

lower costs for city councils, recycling companies, manufacturing plants, and other stakeholders.[42] Projects like IBM's Recology, which attempts to help San Francisco achieve zero waste by 2020, also provide a range of technologically-driven services, such as determining "types and quantities of materials in San Francisco's waste stream, pinpointing the location, types, and amounts of waste that need to be collected for sorting or composting," or identifying "the most effective recycling programs to provide in different business districts and neighborhoods."[43] With new electronic devices appearing everywhere in the city landscape, "smart garbage" to deal with electronic waste may soon become a critical support system.[44]

Whereas infrastructure management is one of the most complex tasks a city government faces, private sector smart city technologies can help. For example, smart water initiatives are the remit of enterprise platforms like IBM's Intelligent Operations for Water, which provides efficiency analytics, sewer overflow mitigation schemes, conservation and smart metering services, irrigation plans for parks, wastewater situational awareness and quality management, pressure and leak management, urban flood management, and scheduling optimization.[45] When even city-wide infrastructure fails, urban residents can step up and engage with city services themselves, for example by privately broadcasting malfunctions or unsafe conditions to other residents through apps.[46]

Although these are just a few of the ways that big data has brought cities to life, it is clear that smart city technologies come in an astounding range of shapes and sizes. Chicago's "Array of Things"

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42. Perera et al., *supra* note 34, at 6.

43. *IBM, Recology Drive San Francisco Toward Zero-Waste Status*, ENVTL. LEADER (June 1, 2012), http://www.environmentalleader.com/2012/06/01/ibm-recology-drive-san-francisco-toward-zero-waste-status/.

44. *See* Jenna Wortham, *The Next Big Thing in Hardware: Smart Garbage*, N.Y. TIMES BITS BLOG (July 24, 2014, 2:04 PM) ("The most recent data available on the Environmental Protection Agency's website is from 2009, when the agency estimated that five million tons of electronics was in storage and 2.37 million was ready for disposal. Only a quarter was recycled; the rest most likely went into landfills or incinerators."), http://bits.blogs.nytimes.com/2014/07/24/the-next-big-thing-in-hardware-smart-garbage/.

45. *IBM Intelligent Water,* IBM, http://www.ibm.com/smarterplanet/us/en/ smarter_cities/solutions/solution/infrastructure_solutions/J103636F12674V34.html (last visited June 18, 2014).

46. For example, the Open City project *"Is there sewage in the Chicago River"* is a non-governmental site designed to track and notify Chicagoans whenever raw sewage is released into Chicago area rivers. *History of Combined Sewer Overflows*, IS THERE SEWAGE IN THE CHI. RIVER, http://istheresewageinthechicagoriver.com/ history (last visited June 18, 2014).

network is one example of this "new form of civic infrastructure" already labeled "Your Big (Friendly) Brother," the Array of Things consists of "highly visible, aesthetically pleasing, one-foot-square boxes mounted on light poles that track environmental conditions around them" and make the data publicly available.[47] Able to empower a diverse range of stakeholders, these new technologies have begun to carve out new niches to help make city living more efficient and cost-effective, offering both short- and long-term benefits. These technologies also open up new conversations—and new ways *to converse*—between city leaders and city residents, creating room for the cultural growth and democratic impulses that have caused modern cities to flourish.[48] Smart cities have much to commend; yet, there are lingering concerns. Everywhere that smart city technologies may be found, they raise significant privacy and civil liberties issues.[49] The following section describes the risks inherent in increasingly persistent surveillance not only in public spaces but also in city dwellers' homes, cars, and offices.

II. Smart City Challenges: Life Inside the Panopticon

A. Inviting the Government In

1. Pre-Urban Privacy

In a recent workshop organized by the Federal Trade Commission to assess privacy issues related to the Internet of Things, Vint Cerf, Google's Chief Internet Evangelist and one of the founders of the Internet, said that privacy may be an anomaly, an artificial construct of the industrial age.[50] In a small village or town, Cerf argued, "the postmaster knew pretty much what everybody was doing because he saw all of the letters going back and forth . . . in the town of 3,000 people, there is no privacy. Everybody knows what everybody is

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47. Susan Crawford, *Chicago Is Your Big (Friendly) Brother*, Bloomberg View (June 19, 2014, 3:48 PM), http://www.bloombergview.com/articles/2014-06-19/chicago-is-your-big-friendly-brother.

48. *See* Ghent Urban Studies Team, *supra* note 6, at 60.

49. *See* Courtney Humphries, *The Too-Smart City,* Boston Globe (May 19, 2013), *available at* http://www.bostonglobe.com/ideas/2013/05/18/the-too-smart-city/q87J17qCLwrN90amZ5CoLI/story.html.

50. Vint Cerf, Vice President and Chief Internet Evangelist, Google Inc., Keynote Address at the Federal Trade Commission Internet of Things Workshop (Nov. 19, 2013) (transcript available at http://www.ftc.gov/sites/default/files/documents/public_events/internet-things-privacy-security-connected-world/final_transcript.pdf (last visited Oct. 18, 2014)).

doing."[51] He posited that "the industrial revolution and the growth of urban concentrations . . . led to a sense of anonymity, which in some ways leads us to believe that we have privacy because nobody knows who we are."[52]

While unleashing a wave of public criticism (including by one of the authors of this article),[53] Cerf's comments were not entirely unfounded. The 1973 U.S. Secretary of Health, Education, and Welfare privacy report (HEW Report) observed that:

> An agrarian, frontier society undoubtedly permitted much less personal privacy than a modern urban society, and a small rural town today still permits less than a big city. The poet, the novelist, and the social scientist tell us, each in his own way, that the life of a small-town man, woman, or family is an open book compared to the more anonymous existence of urban dwellers.[54]

In his foundational book *Privacy and Freedom*, Alan Westin described pre-industrial cultures and societies in which the modern concept of privacy is unknown.[55] He referred to work by cultural anthropologists such as Dorothy Lee, Margaret Mead, and Livingston Jones.[56] Mead reported, for example, that in the Samoan house there were no walls, with only mosquito nets to separate the sleeping quarters of married couples from those of their children and parents.[57] Adults wore little clothing and children none; the beaches were used openly as latrines.[58] In Samoa, wrote Mead, "little is mysterious . . . little forbidden."[59] Livingston, writing about the North American Tlingits, noted that "[t]here are no skeletons tucked away in native families, for the acts of one are familiar to all the others. Privacy is hardly known among them."[60]

One need not venture so far in order to reach non-urban societies with little awareness of privacy. Israel's twentieth-century kibbutz,

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51. *Id.* at 147.

52. *Id.*

53. Omer Tene*, Vint Cerf is Wrong. Privacy Is Not An Anomaly*, CENTER FOR INTERNET & SOC'Y (Nov. 22, 2013), http://cyberlaw.stanford.edu/publications/vint-cerf-wrong-privacy-not-anomaly.

54. SECRETARY'S ADVISORY COMM. ON AUTOMATED PERS. DATA SYS., DEP'T OF HEALTH, EDUC., & WELFARE, RECORDS, COMPUTERS, AND THE RIGHTS OF CITIZENS 29–30 (1973) [hereinafter HEW Report] *available at* http://www.justice.gov/opcl/docs/rec-com-rights.pdf.

55. ALAN WESTIN, PRIVACY AND FREEDOM 8–21 (2d ed. 2014).

56. *Id.* at 11–12.

57. *Id.* at 12.

58. *Id.*

59. *Id.* (internal quotation marks omitted).

60. *Id.* (internal quotation marks omitted).

with its lack of private property, equal distribution of income, noncash economy, communal dining halls, and separate residences for children outside their parents' homes, was notorious for its lack of private spaces.[61] One commentator wrote, "[t]he close proximity of members and their repeated interaction—coupled with the fact that gossip was rampant—facilitated information transmission and increased the effectiveness of social sanctions."[62]

The severity of social sanctions in a tight-knit society has been explored by many authors, in both pre-urban and urban communities.[63] The post-industrialized city full of strangers, however, presented individuals with an opportunity for a fresh start. Like Karl Rossmann, the protagonist of Franz Kafka's *Amerika*, who arrives in New York to escape the embarrassment of his past indiscretion,[64] they no longer have to carry their social status, family affiliation, and individual history in a transparent backpack as a lasting reminder of their place in society.[65]

Now, they can blend into the masses, leading an individual life and proactively managing their engagement—and data sharing—with relatives, friends, and colleagues.[66] Moreover, in the city "[t]here can be something enjoyable, even revelatory about that feeling of self-protection."[67] Virginia Woolf, among other modern authors, was fascinated by this aspect of city life, and highlighted in *Mrs. Dalloway* "the feeling of solitude-on-display that the sidewalk encourages, and by the way that 'street haunting,' as she called it, allows you to lose and then find yourself in the rhythm of urban novelty and familiarity."[68] At the same time, this urban anonymity also imposes steep costs—including the loss of social cohesion and a sense of

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61. *See* Ran Abramitzky, *Lessons from the Kibbutz on the Equality–Incentives Trade-off*, 25 J. ECON. PERSP. 185 (2011).

62. *See id.* at 200.

63. *See, e.g.*, GEORGE ELIOT, MIDDLEMARCH: A STUDY OF PROVINCIAL LIFE (1874); THOMAS HARDY, TESS OF THE D'URBERVILLES (1891); NATHANIEL HAWTHORNE, THE SCARLET LETTER (1850). More modern depictions, such as Jim Crace's novel *Harvest* or Lars von Trier's film *Dogville,* also present the suffocating daily routine and stifling social edicts of non-urban life. JIM CRACE , HARVEST (2013); DOGVILLE (Zentropa Entertainments 2003).

64. FRANZ KAFKA, AMERIKA 3 (Willa Muir & Edwin Muir trans., Schocken Books, 7th ed. 1969).

65. GHENT URBAN STUDIES TEAM, *supra* note 6, at 390.

66. *Id.* at 310–11.

67. Joshua Rothman, *Virginia Woolf's Idea of Privacy*, THE NEW YORKER (July 9, 2014),   http://www.newyorker.com/books/joshua-rothman/virginia-woolfs-idea-of-privacy.

68. *Id.*

community; the unresponsiveness of local government to citizen concerns; and the inevitable loneliness of an anonymous life.[69]

2.   Urban Government

Perhaps then, as Cerf suggested, smart city technologies merely turned the wheel back in time to the "natural" state of community, moderating urban anonymity with social networks and aiding local government with seamless information sharing and feedback loops.[70] Yet, a profound difference between privacy concerns of pre-industrial towns and those raised in hyperconnected cities lies in the power dynamics among stakeholders. While traditional cultures and small villages saw information shared horizontally among citizens, the new urban landscape features a dramatic shift to vertical information sharing between citizens and government.[71] In villages, individuals who shared conversation with the postman or their purchase habits with a shopkeeper were actively engaging and exchanging information with other *people* in their communities; in the modern city, their information is more often mechanically (and unilaterally) gathered, analyzed, and eventually channeled into permanent government databases. Consequently, while in rural environments the main privacy concerns implicated gossip, embarrassment, and social sanction, smart cities portend surveillance, paternalism, discipline, and punishment.[72]

As the HEW Report observed, in 1973:

> [T]he individual in a small town can retain his confidence because he can be more sure of retaining control. He lives in a face-to-face world, in a social system where irresponsible behavior can be identified and called to account. By contrast, the impersonal data system, and faceless users of the information it contains, tend to be accountable only in the formal sense of the word. In practice they are for the most part immune to whatever sanctions the individual can invoke.[73]

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69. *See generally* TORD KJELLSTROM ET AL., KNOWLDEDGE NETWORK ON URBAN SETTINGS, OUR CITIES, OUR HEALTH, OUR FUTURE: ACTING ON SOCIAL DETERMINANTS FOR HEALTH EQUITY IN URBAN SETTINGS (July 2007), http://www.who.int/social_determinants/resources/knus_report_16jul07.pdf (discussing social issues arising from urban settings).

70. *See* Cerf, *supra* note 50.

71. *See* Humphries, *supra* note 49.

72. MICHEL FOUCAULT, DISCIPLINE AND PUNISH: THE BIRTH OF THE PRISON (1975).

73. HEW REPORT, *supra* note 54.

Interestingly, traditional village privacy can be analogized to Jonathan Zittrain's "privacy 2.0," which addresses the new generation of privacy concerns that revolve around interpersonal connections in an environment permeated by social networking services and peer produced content.[74] Conversely, smart city privacy issues reflect traditional concerns about the panoptic gaze of a surveillance society. Yet, the technological ecosystem powering smart cities is complex and does not lend itself to ready categorization. It creates a data environment that is at once centralized and de-centralized, with private businesses operating data centers and infrastructure and offering apps and services on account, and sometimes in lieu, of local government entities.[75]

It is ironic that on the one hand, individuals fight hammer and tongs to enforce the Fourth Amendment and keep government data collection at bay;[76] on the other hand, they volunteer information to local government in order to improve urban services.[77] *The Onion*, which once quipped that Facebook was a massive online surveillance program run by the CIA,[78] can now seriously report on the emergence of a mass surveillance apparatus comprised of slickly-designed apps beckoning city dwellers to provision their personal data.[79] While information is provided in apparently distinct verticals—smart grid, transportation, parking, water supply, and waste—it is ultimately a single service provider, municipal government, that obtains a comprehensive, 24/7 view. Tim O'Reilly describes this government of the future as a platform, which aggregates services via disparate apps.[80] Already, Amsterdam, a global leader in smart city technologies, has put together what officials call a "smart-city

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74. Jonathan Zittrain, *Privacy 2.0*, 2008 U. Chi. Legal F. 65, 117; *see generally* Danah Boyd, It's Complicated: The Social Lives of Networked Teens 54–67 (2014) (exploring interpersonal privacy among teens).

75. Townsend, *supra* note 20, at 291.

76. *See* Bart Jansen & Carolyn Pesce, *Anti-NSA Rally Attracts Thousands to March in Washington*, USA Today, Oct. 26, 2013, http://www.usatoday.com/story/news/nation/2013/10/26/nsa-dc-rally/3241417/.

77. *See e.g.*, *Participatory Urbanism*, New Urban Mechanics, http://www.newurbanmechanics.org/projects/participatory-urbanism-projects/ (last visited Oct. 18, 2014).

78. Liz Gannes, *Facebook Actually a CIA Surveillance Program, Says the Onion*, All Things D (Mar. 21, 2011, 12:55 PM), http://allthingsd.com/20110321/facebook-actually-a-cia-surveillance-program-says-the-onion.

79. *See* Townsend, *supra* note 20, at 270–74.

80. *See* Tim O'Reilly, *Government As a Platform*, *in* Open Government (Daniel Lathrop & Laurel Ruma eds. 2010), *available at* http://chimera.labs.oreilly.com/books/1234000000774/ch02.html.

platform," a combination of institutions and infrastructure to help businesses and citizens develop and test green projects.[81]

Clearly, individuals are jaded about warnings against sharing personal information with social networks, online vendors, and apps. Practices once considered "creepy" have now become run-of-the-mill, as consumers have come to accept the value proposition of "free" services in return for personal data.[82] Just two or three years ago, few observers could predict that applications that monitor individuals' health, diet, exercise, and sleep would become socially acceptable, let alone massively popular.[83]   Now, however, not only disparate application developers but also centralized government entities can access such sensitive personal information.[84] The normalization of big data collection by city government increasingly raises the specter of a panoptic gaze.

B.   Function Creep and Paternalism

Even if concerns about government surveillance are set aside, data aggregation in the hands of urban government gives pause for concern. Unlike when dealing with the private sector, urban residents of smart cities have few alternatives to the government-operated sensors and surveillance technologies increasingly deployed throughout their environs. A consumer who is concerned about a search engine analyzing their interests and tracking their browsing habits has alternatives from which to choose, such as DuckDuckGo, a small, privacy-focused competitor, promising search results that are not based on individualized user data.[85] A consumer concerned about

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81. Ledwig Siegele, *Mining the Urban Data*, Economist, November 21, 2012, *available at* http://www.economist.com/news/21566408-cities-will-become-smarter-different-ways-many-people-expected-mining-urban-data.

82. *See* Klint Finley, *What If Your Boss Tracked Your Sleep, Diet, and Exercise?*, Wired (Apr. 17, 2013), http://www.wired.com/2013/04/quantified-work-citizen/; *see also* Parmy Olson, *Wearable Tech Is Plugging Into Health Insurance*, Forbes, June 19, 2014, http://www.forbes.com/sites/parmyolson/2014/06/19/wearable-tech-health-insurance/.

83. *See* Tony Danova, *Chart: Health and Fitness App Usage Is Growing Faster Than App Usage Overall*, Business Insider (June 25, 2014), http://www.businessinsider.com/chart-health-and-fitness-app-usage-is-growing-faster-than-on-all-other-apps-combined-2014-6.

84. Exec. Office of the President, Big Data: Seizing Opportunities, Preserving Values 30–35 (May 2014), http://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_may_1_2014.pdf [hereinafter White House Report].

85. *About Us*, DuckDuckGo, https://duckduckgo.com/about (last visited June 30, 2014) ("Our Vision is Simple. To give you great search results without tracking you.").

dissemination and use of social networking data can opt out of Facebook and into more privacy-minded options such as Whisper[86] or Cloaq.[87]

In the market, privacy can be a competitive differentiator, and users have some degree of control over when and how to exchange data for services. In a smart city, however, urbanites have few, if any, alternatives, particularly when it comes to essential infrastructure. Cities will have only one smart grid, one subway system, and one set of emergency services available to the public. Public services have captive populations who cannot opt out of information collection without paying a steep price in safety, convenience, and quality of life. Recommendations for how to stay off the grid include a host of anti-surveillance techniques (e.g., paying only in cash, avoiding loyalty cards, doing without a mobile phone, limiting driving—and avoiding bridges, tolls, and major highways when doing so—and using maps instead of GPS)[88] and technologies (e.g., fingerprint gel, white noise generators, faraday cages to block mobile device signals, and LED-lined clothing to white out infrared signals).[89] Even services designed to help urbanites avoid CCTV cameras, such as i-SEE in Manhattan, can chart only "paths of *least* surveillance."[90] Moreover, because smart cities deploy a wide array of sensors and monitoring technologies through shared infrastructure systems, even those city dwellers who select privacy-aware services will inevitably find their activities tracked in public by default.

In addition to lacking competitive forces that might preserve pro-privacy choices, government-centric surveillance carries additional risk in its institutional opacity. A citizen who provides data to city

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86. Rich McCormick, *Anonymous Social Network Whisper Now Lets You Search for Secrets in Your City*, THE VERGE (May 19, 2014, 10:30 AM), http://www.theverge.com/2014/5/19/5730392/whisper-anonymous-social-network-gets-big-update.

87. Sarah Perez, *Cloaq, The Anonymous Social App That Doesn't Require an Email or Phone Number, Goes Live*, TECHCRUNCH (Apr. 30, 2014), http://techcrunch.com/2014/04/30/cloaq-the-anonymous-social-app-that-doesnt-require-an-email-or-phone-number-goes-live/.

88. *See* Daniel Jennings, *How to Stay Off the Surveillance Radar*, OFFTHEGRIDNEWS (Aug. 21, 2013), http://www.offthegridnews.com/2013/08/21/how-to-stay-off-the-surveillance-radar/.

89. *See* Betsy Isaacson, *How to Disappear: 9 Ways to Avoid the Creepy Surveillance Systems All Around You*, HUFFINGTON POST (Sept. 8, 2012, 5:18 PM), http://www.huffingtonpost.com/2012/09/18/how-to-disappear-avoid-surveillance_n_1872419.html.

90. *See i-SEE: "Now More Than Ever"*, INST. FOR APPLIED AUTONOMY, http://www.appliedautonomy.com/isee.html (last visited Oct. 18, 2014) (*emphasis added*).

hall for one purpose—by sending in metadata-rich photos of potholes, for instance—may not know precisely where within the labyrinthine of local (and state, and potentially federal) bureaucracy her data may reside.[91]   Furthermore, that person might never have provided the data if he or she knew it might find new life in the hands of a police department, a commercial partner, or a public record. Moreover, the interconnectedness of smart city technologies and data platforms will inevitably muddy the bureaucratic waters, particularly when data-driven infrastructure is outsourced to private tech companies.[92]

The slippery slope eroding privacy rights seems set to lead to city governments not simply monitoring their citizens' lives, but also using connected technologies to shape them. Government surveillance is already driven by paternalistic impulses to protect citizens, whether against outsiders or from each other.[93]   However smart city technologies also introduce the potential for much more individualistic paternalism—potentially allowing cities to 'protect' citizens from themselves. It might seem a step too far today to imagine that a public escalator equipped with Fitbit-style personal metrics would selectively decide whether to let an individual ride or automatically deactivate, forcing her to stretch her muscles on the stairs. In fact, a similar mission, saving lives and healthcare dollars,[94]

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91. *Street Bump Mobile Applications Terms of Service*, CITY OF BOS., http://www.cityofboston.gov/DoIT/apps/streetbump_terms.asp ("4. WHO SEES WHAT DATA: *The City of Boston:* All of your submitted data is accessible to the City of Boston and the partners working with it on this project. Because this is an effort of the City of Boston, all data you submit using Street Bump may be subject to any and all applicable City, State and Federal public records laws. This includes both operational and enhancement-related information.") (last visited June 18, 2014).

92. *See, e.g.*, Natasha Singer, *Mission Control, Built for Cities: IBM Takes 'Smarter Cities' Concept to Rio de Janeiro*, N.Y. TIMES, Mar. 3, 2012, *available at* http://www.nytimes.com/2012/03/04/business/ibm-takes-smarter-cities-concept-to-rio-de-janeiro.html.

93. For example, the NSA's warrantless mass surveillance programs were justified as necessary for national security, protecting U.S. citizens against terrorist plots; extensive networks of urban CCTV cameras are heralded by authorities around the world as important weapons against domestic crime. *See* JULIA ANGWIN, DRAGNET NATION 45–47 (2014); *see also* WESTIN, *supra* note 55, at 56–66 (noting, for example, that "[s]urveillance is obviously a fundamental means of social control. Parents watch their children, teachers watch students, supervisors watch employees . . . and government agencies watch the citizen's performance of various obligations and prohibitions" and that "many societies in the past required registration of residences, movements, and transactions, and used elaborate dossiers and permits as a mechanism of administrative social control.").

94. Or perhaps not that far off. *See* Norimitsu Onishi, *Japan, Seeking Trim Waists, Measures Millions*, N.Y. TIMES, June 13, 2008, *available at* http://www.nytimes.com/2008/06/13/world/asia/13fat.html ("Under a national law that came into effect two months ago, companies and local governments must now

has already been leveraged by the New York City Mayor's Office to justify banning large cups of sugary drinks, as part of its public health agenda to combat obesity.[95] Although that measure is largely seen as a failure,[96] it is easy to see in it the beginning of an incremental function creep by local governments into more intrusive uses of personal data. Further, while such intentions are surely noble, they are also paternalistic and could quickly become oppressive.

In London, Dubai, and the Chinese city of Chongqing, "CCTV cameras keep a watchful eye on practically every street corner."[97] In New York, smart sensors have been reported to actively read E-ZPasses all over the city, not just at toll booths as most drivers surely assumed.[98] These cameras and sensors enable smart cities to better fight crime and manage traffic; they also provide a foundation for massive public surveillance apparatuses that curtail individual privacy by default. Further, as the lines between government and commercial surveillance continue to blur in hyperconnected cities, so too do the lines between monitoring behavior and changing it. Facebook and OKCupid have both recently revealed that they deliberately and subtly modified consumer behaviors;[99] governments with access to

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measure the waistlines of Japanese people between the ages of 40 and 74 as part of their annual checkups. That represents more than 56 million waistlines, or about 44 percent of the entire population . . . . Those exceeding government limits . . . and having a weight-related ailment will be given dieting guidance if after three months they do not lose weight. If necessary, those people will be steered toward further re-education after six more months.").

95. Michael M. Grynbaum, *New York Plans to Ban Sale of Big Sizes of Sugary Drinks*, N.Y. TIMES, May 30, 2012, *available at* http://www.nytimes.com/2012/05/31/nyregion/bloomberg-plans-a-ban-on-large-sugared-drinks.html.

96. The legal status of the ban is currently under appeal in New York's highest court. *See* Glenn Blain, *State's Highest Court Hears Arguments on New York City's Push to Ban Large Sodas and Other Sugary Drinks*, N.Y. DAILY NEWS, June 4, 2014, http://www.nydailynews.com/news/politics/new-york-city-push-ban-big-sodas-reaches-state-highest-court-article-1.1817313.

97. *Clever Cities: The Multiplexed Metropolis*, *supra* note 7. For example, a 2013 study estimated that there were between 4 million and 5.9 million closed-circuit television (CCTV) cameras in the United Kingdom (or one camera per eleven to fourteen people), which are designed to produce images or video recordings for public and private surveillance purposes. David Barrett, *One Surveillance Camera for Every 11 People in Britain, Says CCTV Survey*, TELEGRAPH, July 10, 2013, http://www.telegraph.co.uk/technology/10172298/One-surveillance-camera-for-every-11-people-in-Britain-says-CCTV-survey.html.

98. *See* Hill, *supra* note 26.

99. Facebook tweaked the balance of emotionally 'positive' or 'negative' posts users saw in order to study whether that would impact user's own posting habits, while OKCupid displayed false match ratings, sending users on dates it predicted would not go well in order to test its compatibility algorithms. *See* Erica Portnoy, *Facebook Study a Rare Public Reminder of Corporate Big Data's Unaccountable*

similar information pools may one day also choose to secretly influence individual decision-making, in the interests of science or a balanced budget or public health and safety. Smart city technologies are everywhere, and everywhere they carry the risk of government encroachment into individual rights and freedoms.

C. Sensors Under the Skin

As the United States moves firmly into the era of the Internet of Things, its denizens are introducing ubiquitous surveillance and next-generation sensors into every aspect of their daily lives—including in their homes, their offices, and on their own bodies. The "Internet of Things" is the newest wave in ubiquitous computing, a term used to describe the array of internet-enabled devices (like cars and traffic lights but also coffee pots and clothes) that are entering our everyday lives.[100] These devices not only collect increasingly specific personal information; but they also can share that data with other people and other devices.[101] In the not-so-distant future, a public school teacher in New York City might begin her day with a coffee recipe she sent to her machine from an app,[102] a refrigerator that adds milk to her grocery list,[103] and a cup that detects what she is drinking, displays the nutritional content, and reports her drinking habits to her smartphone—all before she walks out the door (which locks itself and syncs to her phone) and into the smart city.[104] Once she enters the urban space, CCTV cameras equipped with facial recognition will watch her as she walks to the subway,[105] and allow her to pay her fare

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Power, EQUAL FUTURE (July 2, 2014), http://equalfuture.us/2014/07/02/facebook-study-a-rare-reminder/; Christian Rudder, *We Experiment on Human Beings!*, OKCUPID (July 28, 2014), http://blog.okcupid.com/index.php/we-experiment-on-human-beings/.

100. *Internet of Things—Privacy and Security in a Connected World*, FED. TRADE COM'M, http://www.ftc.gov/news-events/events-calendar/2013/11/internet-things-privacy-security-connected-world (last visited Oct. 18, 2014).

101. *Id.*

102. Stephen Shankland, *Philips Brings Net Smarts to Coffeemaker, Cooker, Air Purifier*, CNET (Sept. 6, 2013), http://www.cnet.com/news/philips-brings-net-smarts-to-coffeemaker-cooker-air-purifier/.

103. Sam McNerney, *Smart Fridge Manages Your Grocery List And Monitors Food Freshness*, PSFK (Jan. 28, 2012), http://www.psfk.com/2012/01/samsumg-smart-fridge.html.

104. Ellis Hamburger, *Vessyl is the Smart Cup that Knows Exactly What You're Drinking*, THE VERGE (June 12, 2014), http://www.theverge.com/2014/6/12/5801106/vessyl-smart-cup-that-knows-exactly-what-youre-drinking.

105. Heather Kelly, *After Boston: The Pros and Cons of Surveillance Cameras*, CNN (Apr. 26, 2013, 7:03 PM), http://www.cnn.com/2013/04/26/tech/innovation/security-cameras-boston-bombings/.

by presenting her eye for a quick retina scan.[106] Once she is on the train, perspiration sensors[107] will adjust the air conditioning, and smart billboards present individually tailored messages, including scornful criticism over the contents of her lunch box.[108]

Even if full deployment of next-generation sensors has yet to hit mass consumer markets, connected devices and smart technologies are paving the way for ever-more detailed and personalized data collection. The development of smart cities and the Internet of Things alike has been driven forward by the rapid cheapening and miniaturization of the GPS, thermometers, accelerometers, hygrometers, ambient light monitors, and other sensors packed into the smart phone.[109] However, the next set of connected technologies goes even further than analyzing a device's movement and environs.

Bioaware and wearable devices[110]—already available from t-shirts to smart watches, fitness bands to game consoles—track and interpret even more specific and sensitive human data, such as an individual's heartbeats, eye movements, and gait.[111] For example, consumer electronics, such as gaming consoles, currently track players' eye movements, heart rate, and perspiration to gauge their level of excitement during gameplay.[112] Game platforms are developing

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106. *See* Marie Mawad & Adam Ewing, *iPhone Fingerprint Reader Talk Boosting Biometric Stocks*, BLOOMBERG, Aug. 14, 2013, *available at* http://www.bloomberg.com/news/2013-08-13/iphone-fingerprint-reader-talk-boosting-biometric-stocks.html.

107. *See* Laurence Cruz, *Coming, Ready or Not: Cell Phones as Sensors*, CISCO NEWSROOM (Apr. 10, 2013), http://newsroom.cisco.com/feature/1167305/Coming-Ready-or-Not-Cell-Phones-as-Sensors.

108. *See* Rose Powell, *The Billboards Are Watching You: Next Generation Advertising Ready to Launch in Australia and Asia*, SMART COMPANY, Jan. 14, 2014, http://www.smartcompany.com.au/marketing/35134-the-billboards-are-watching-you-next-generation-advertising-ready-to-launch-in-australia-and-asia.html#; Sarah Kessler, *Startup Aims to Build Billboards That Target You, Personally*, MASHABLE, Apr. 15, 2011, http://mashable.com/2011/04/15/smart-billboard/.

109. Andrew DeWit, *Japan's Rollout of Smart Cities: What Role for the Citizens?*, ASIA-PACIFIC J. (June 16, 2014), http://japanfocus.org/-Andrew-DeWit/4131.

110. *Tech-Styles: Are Consumers Really Interested in Wearing Tech on Their Sleeves?*, NIELSEN (Mar. 20, 2014), http://www.nielsen.com/us/en/newswire/2014/tech-styles-are-consumers-really-interested-in-wearing-tech-on-their-sleeves.html (reporting that one in six consumers already use wearable tech).

111. *See* Liat Clark, *Get Ready to Have Your Biometrics Tracked 24/7*, WIRED (Mar. 26, 2014), http://www.wired.co.uk/news/archive/2014-03-26/biometrics-the-good-and-bad.

112. Yannick LeJacq, *No Sweat! Sony Bagged Moisture-Monitoring PlayStation 4 Controllers*, NBC NEWS (July 16, 2013), http://www.nbcnews.com/tech/video-games/no-sweat-sony-bagged-moisture-monitoring-playstation-4-controllers-f6C10652514.

"immersive virtual reality headsets that accurately track a player's head movement in three dimensions."[113] At the same time, games are collecting and analyzing players' social and physical behaviors *within* the game, or "telemetrics," so that "every fraction of a move of an avatar, every button press, all purchases made, every single chat message, [and] all the server-side system information" can be used to identify behavioral patterns and predict different player personalities.[114]

Although truly dystopian smart city technologies remain rhetorical specters rather than practical realities, an expanding world of sensors that can recognize autonomic bodily reactions and more complex emotional responses nevertheless paves the way for societal chilling effects. After all, almost seventy years ago, George Orwell surmised that one day it would be perilous to "let your thoughts wander when you were in any public space or within range of a telescreen" because "[t]he smallest thing could give you away. A nervous tic, an unconscious look of anxiety, a habit of muttering to yourself—anything that carried with it the suggestion of abnormality, of having something to hide."[115]

As society becomes accustomed to the Internet of Things and overtly connected and data-driven technologies proliferate in homes, cars, and other personal spaces, ubiquitous public surveillance will increasingly fade into the background of daily life. Face and object detectors are already widely deployed throughout urban landscapes, both as safety measures (the police in lower Manhattan can track cars and people moving south of Canal Street and even detect unattended packages)[116] and as energy conservation tools (motion sensors on smart streetlights can save an additional twenty to thirty percent on energy by dimming lights during hours of low activity, as well as tracking noise and pollution levels).[117]

The normalizing of constant data collection and bioaware sensors invites private companies literally under our skin; it also opens the door to new forms of government surveillance. Indeed, good intentions notwithstanding, connecting the human body—with its

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113. Joe Newman et al., *"Press Start to Track?" Privacy and the New Questions Posed by Modern Videogame Technology*, AM. INTELL. PROP. L. ASS'N Q. J. (forthcoming 2014) (manuscript at 8) (on file with authors).

114. *Id.* at 9.

115. *See* GEORGE ORWELL, 1984 (1949).

116. Kelly, *supra* note 105.

117. Martin LaMonica, *LED Streetlights Bring Smart City Tech to New York City*, GREENBIZ (Oct. 29, 2013), http://www.greenbiz.com/blog/2013/10/28/led-streetlights-bring-smart-city-tech-new-york-city.

physical, behavioral, and psychological individuality—to a government managed grid raises concerns about privacy, surveillance, control, and chilling effects.

D. Discrimination and Data Overload

1. Discrimination

In urban and nonurban settings, big data analysis exacerbates concerns about unfairness and discrimination.[118] It allows for granular distinctions to be made between individual characteristics, preferences, and activities. Reports by the Federal Trade Commission, for example, indicate that data brokers regularly categorize consumers by inferred interests, sorting them in categories like "Dog Owner," "Winter Activity Enthusiast," "Expectant Parent," or "Diabetes Interest," and into age-, ethnicity- and income-focused categories like "Urban Mixers" (which includes "a high concentration of Latinos and African Americans with low incomes") or "Rural Everlasting" (which includes "single men and women over the age of 66 with 'low educational attainment and low net worths'").[119]

Big data analytics can help mask discriminatory intent behind apparently innocuous mirrors and proxies.[120] For example, disparate policies based on location can implicate redlining, the act of denying or increasing the cost of services to residents of neighborhoods comprised mostly of minorities.[121] Urban preemptive policing schemes are another area where data-driven policies could mask discriminatory agendas.[122] The use of historical arrest statistics for targeted law enforcement efforts appears on its face to be a neutral, logical choice; however, given "the history of over-enforcement in

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118. Cynthia Dwork & Deirdre K. Mulligan, *It's Not Privacy and It's Not Fair*, 66 STAN. L. REV. ONLINE 35, 35–36 (2013), http://www.stanfordlawreview.org/online/privacy-and-big-data/its-not-privacy-and-its-not-fair.

119. FED. TRADE COMM'N, DATA BROKERS: A CALL FOR TRANSPARENCY AND ACCOUNTABILITY (2014), http://www.ftc.gov/system/files/documents/reports/data-brokers-call-transparency-accountability-report-federal-trade-commission-may-2014/140527databrokerreport.pdf.

120. WHITE HOUSE REPORT, *supra* note 84, at 46.

121. THE URBAN INST., MORTGAGE LENDING DISCRIMINATION: A REVIEW OF EXISTING EVIDENCE (Margery Turner & Felicity Skidmore eds. 1999).

122. Andrew Guthrie Ferguson, *Predictive Policing and Reasonable Suspicion*, 62 EMORY L.J. 259, 322–24 (2012); *see also* Bryan Llenas, *The New World of 'Predictive Policing' Belies Specter of High-Tech Racial Profiling*, FOX NEWS LATINO, Feb. 25, 2014, http://latino.foxnews.com/latino/news/2014/02/24/brave-new-world-predictive-policing-raises-specter-high-tech-racial-profiling/.

communities of color (which is reflected in these numbers) . . . . Over time, minor crimes that occur in these communities may be prosecuted while the same crimes occurring elsewhere go unrecorded—leading to an exaggerated "objective" record of the targeted neighborhood's higher crime rate."[123] The New York City Police Department's CompStat process, which uses data to track and target crime, drove the NYPD's controversial stop-and-frisk program.[124] Widely cited by city officials, including the mayor, as a linchpin of New York's success in reducing murders and major crime rates to historically low levels,[125] the data-driven stop-and-frisk policy was accused by critics of actively targeting African American and Hispanic residents.[126] Between 2004 and 2012, about 83% of the stops involved African Americans or Hispanics, even though those two demographics made up just more than 50% of the city's residents.[127]

In August 2013, U.S. District Court Judge Shira Scheindlin ruled that the NYPD's stop-and-frisk tactics constituted a "policy of indirect racial profiling," leading officers to routinely stop "blacks and Hispanics who would not have been stopped if they were white."[128] The judge wrote that "the city's highest officials have turned a blind eye to the evidence that officers are conducting stops in a racially discriminatory manner."[129] While in this case data-driven discrimination was stopped in its tracks, in many other cases it may slip through unnoticed, aided by the data overflow and opaqueness of algorithms. Given the glut of increasingly personal information and predictive inferences available, decisions based on illegal discriminatory inferences—as opposed to those driven by millions of

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123. David Robinson, *Are We Rushing to Judgment Against the Hidden Power of Algorithms?*, FREEDOM TO TINKER (July 30, 2014), https://freedom-to-tinker.com/blog/dgr/are-we-rushing-to-judgment-against-the-hidden-power-of-algorithms/.

124. N.Y.C. BAR ASS'N, REPORT ON THE NYPD'S STOP-AND-FRISK POLICY 3 (2007), *available at* http://www2.nycbar.org/pdf/report/uploads/20072495-StopFriskReport.pdf.

125. David W. Chen, *Survey Raises Questions on Data-Driven Policy*, N.Y. TIMES, Feb. 8, 2010, *available at* http://www.nytimes.com/2010/02/09/nyregion/09mayor.html.

126. Colleen Long, *NYPD Wrongly Targeted Minorities, Judge Rules*, ASSOCIATED PRESS, Aug. 12, 2013, http://bigstory.ap.org/article/us-judge-orders-nypd-stop-and-frisk-monitor.

127. Editorial, *Racial Discrimination in Stop-and-Frisk*, N.Y. TIMES, Aug. 12, 2013, *available at* http://www.nytimes.com/2013/08/13/opinion/racial-discrimination-in-stop-and-frisk.html.

128. Floyd v. City of New York, 959 F. Supp. 2d 540, 603–05 (S.D.N.Y. 2013).

129. *Id.* at 562.

other possible predictive inferences—may be difficult to find in the big data haystack.[130]

Moreover, smart city services may result in discriminatory impact inadvertently, even in the absence of malign intent. For example, in its recent report on big data, the White House described Street Bump, a smart city app developed in Boston, which uses cellphones' accelerometer and GPS data to report information about road conditions, including potholes, to the city's Public Works Department.[131] The deployment of the system has been successful, with the app reporting more than 30,000 potholes and helping the city identify road castings like manholes and utility covers as the biggest obstacle for drivers.[132] Yet, because the poor and the elderly are less likely to carry smartphones or download the Street Bump app, its usage threatened to divert city services away from those populations and into younger, wealthier neighborhoods.[133] The White House reports that "[t]o its credit, the city of Boston and the Street Bump developers figured this out before launching the app."[134] They corrected the bias by first handing the app out to city-road inspectors, who service all parts of the city equally, relying on the public for only additional supporting data.[135]

2. Data Overload

In his book, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia*, Anthony Townsend expressed alarm about smart cities becoming "buggy, brittle and bugged."[136] As with any complex interrelated technological infrastructure, smart city systems are vulnerable to attacks by hackers or software bugs causing extended blackouts, massive traffic jams, communications shutdowns, or

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130. On the other hand, sometimes it is not so difficult. *See* Lydia O'Connor, *'Ghetto Tracker,' App that Helps Rich Avoid Poor, Is As Bad As It Sounds*, HUFFINGTON POST (Sept. 4, 2013), http://www.huffingtonpost.com/2013/09/04/ghetto-tracker_n_3869051.html (describing an app that "functions by allowing locals to rate the safety of different parts of a given area. According to *The Week*, the original launch of the page featured a white family of four smiling alongside the app's promise to show users 'which parts of town are safe and which ones are ghetto, or unsafe.'").

131. CITY OF BOS., *supra* note 91; *see also* Phil Simon, *Potholes and Big Data: Crowdsourcing Our Way to Better Government*, WIRED (Mar. 25, 2014), http://www.wired.com/2014/03/potholes-big-data-crowdsourcing-way-better-government.

132. WHITE HOUSE REPORT, *supra* note 84, at 52.

133. *Id.* at 51–52.

134. *Id.* at 52.

135. *Id.*

136. TOWNSEND, *supra* note 20, at 282.

wasteful water spills.[137]   Given that any device connected to the Internet is exposed to cyberattack, smart cities multiply the potential for security breaches that could impact critical systems. Over the past few years, cyberattacks on supervisory control and data acquisition (SCADA) systems have multiplied in number and sophistication, ranging from a sole hacker disrupting a water utility in Illinois[138] to powerful nation states launching a crippling assault on a nuclear reactor in Iran.[139]

Cyberattacks will affect not only security, but also privacy. Critics argue that "[t]he quest to centrali[z]e the distributed and messy yet highly resilient intelligence of existing cities within a single network or piece of software appears quixotic at best."[140] With millions of citizens, commuters, and visitors interacting with multiple systems to create trillions of data points each day, smart cities will generate a deafeningly noisy data exhaust. This, in turn, will spawn huge quantities of incomplete, imprecise, and conflicting data; biased sampling; and outliers, inevitably yielding correlations that imply spurious causation. Pulling actionable conclusions out of the noise could be daunting. Further, while in other areas such as Netflix film recommendations, the potential harm of an erroneous inference may be as small as an evening wasted, in urban management it could lead to diverting city resources away from the needy or performing unjustified arrests.

This phenomenon is manifest in the recent debate around the soundness of the NYPD's stop-and-frisk policies. In her 198-page decision in *Floyd v. City of New York*, Judge Scheindlin parsed through an evidentiary record that includes statistical analysis of more than 4.4 million stops in New York City from January 2004 to June 2012.[141] She was guided by plaintiff's expert witness, Dr. Jeffrey Fagan, a criminologist at Columbia Law School, whose analysis was countered by two scholars commissioned by the City.[142] Fagan, for

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137. *See id.* at 282–299.

138. Jaikumar Vijayan, *Apparent Cyberattack Destroys Pump at Illinois Water Utility*, COMPUTERWORLD (Nov. 18, 2011), http://www.computerworld.com/s/article/9222014/Apparent_cyberattack_destroys_pump_at_Ill._water_utility.

139. Ellen Nakashima & Joby Warrick, *Stuxnet Was Work of U.S. and Israeli Experts, Officials Say*, WASH. POST, June 2, 2012, http://www.washingtonpost.com/world/national-security/stuxnet-was-work-of-us-and-israeli-experts-officials-say/2012/06/01/gJQAlnEy6U_story.html.

140. *Smart Cities: Are Smart Cities Empty Hype?*, ECONOMIST, Dec. 2013, http://www.economist.com/debate/debates/overview/265.

141. Floyd v. City of New York, 959 F. Supp. 2d 540, 556 (S.D.N.Y. 2013).

142. *Id.* at 576–78.

example, conducted regression analysis on NYPD data, concluding that police stops were "significantly more frequent for Black and Hispanic citizens than for white citizens, after adjusting stop rates for the precinct crime rates, the racial composition and other social and economic factors predictive of police activity."[143] He used an area's population and reported crime rate as benchmarks for understanding the racial distribution of stops.[144] The City's experts interpreted *the same data* differently, based on an assumption that if officers' stop decisions were racially unbiased, then the racial distribution of stopped pedestrians would be the same as the racial distribution of the criminal suspects in the area.[145] Suffice it to say, that with all the noise, the relationship between crime, stops, other law enforcement practices, and related social and economic factors is difficult, if not impossible, to measure.[146]

Are all of the smart city's good intentions, idealistic promises, and innovative technologies nothing but a disguise for increasingly intrusive governmental and corporate interests? Should city-goers look up from their smartphones and begin to mobilize to assert their right to be free from the grip of the urban panopticon closing in around them? Not today. While the privacy risks arising from smart cities and big data are real and significant, there remain ways to mitigate them without losing most of the compelling benefits that arise from smart data use. Monitoring technologies and predictive analytics create privacy concerns, but as the following Part shows, they may also be part of a framework that engenders trust, empowers urban populaces, and creates new value through personalization.

III. SMART PRIVACY FOR SMART CITIES

The scale on which smart cities collect, analyze, and exploit data about their citizens could set them apart from any other surveillance mechanism in history.[147] Driven by big data analytics, smart cities are

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143. Report of Jeffrey Fagan, Floyd v. City of New York, 959 F. Supp. 2d 540 (S.D.N.Y. 2013) (No. 08 Civ. 01034).

144. *Floyd*, 959 F. Supp. 2d at 583.

145. *Id.* at 584.

146. David Rudovsky & Lawrence Rosenthal, *The Constitutionality of Stop-and-Frisk in New York City*, 162 U. PA. L. REV. ONLINE 117, 147 (2013); *see generally* David F. Greenberg, *Studying New York City's Crime Decline: Methodological Issues,* 31 JUST. Q. 154 (Jan. 10, 2013), *available at* http://www.tandfonline.com/doi/abs/10.1080/07418825.2012.752026#.Uo4IYqHzb-s#preview.

147. While the NSA's warrantless surveillance efforts, for example, have given it extensive access to U.S. communications records, a smart city like Boston or New York could access not only those same records and metadata, but could more easily

processing and making decisions based on increasingly specific personal information about millions of individuals, using everything from faceprints to shopping patterns to geolocation to energy use.[148] Although society's general tolerance for government surveillance may change over time, some of the privacy concerns implicated by data-driven cities have already arisen in other contexts.[149] Attempts to strike a reasonable balance between the public benefits of big data and the loss of individual privacy have sparked fierce debate and reform proposals in other essential civic sectors like healthcare, financial services, e-government, and education.[150]

Crafting solutions to big data problems requires the engagement and cooperation of multiple stakeholders, including policymakers, professionals, and urban dwellers themselves. In a legal environment which has yet to impose significant regulations on big data or the new "Internet of Things,"[151] the path forward should be instructed by a combination of legal and technological solutions that will foment the development of new social norms around personal data, while simultaneously not stifling innovation and progress.

A. Engendering Trust

Popular visions of futuristic cities (increasingly trending towards the dystopic),[152] often illustrate untrustworthy, ubiquitous

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combine it with data from dedicated public CCTV cameras and sensors, utilities usage and payment records, public transit records and biometrics and facial recognition records. *See* Glen Greenwald, *NSA Collecting Phone Records of Millions of Verizon Customers Daily*, GUARDIAN, June 5, 2013, http://www.theguardian.com/world/2013/jun/06/nsa-phone-records-verizon-court-order.

148. *See Clever Cities: The Multiplexed Metropolis*, *supra* note 7.

149. WHITE HOUSE REPORT, *supra* note 84 (discussing big data and health care delivery, education, law enforcement, and private-sector activities).

150. *See, e.g.*, Jules Polonetsky & Omer Tene, *Who is Reading Whom Now: Privacy in Education from Books to MOOCs*, 17 Vand. J. Ent. & Tech. L. (forthcoming) (manuscript available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2507044).

151. Cerf, *supra* note 50. The "Internet of Things" is "a term used to describe the ability of devices to communicate with each other using embedded sensors that are linked through wired and wireless networks. These devices could include your thermostat, your car, or a pill you swallow so the doctor can monitor the health of your digestive tract. These connected devices use the Internet to transmit, compile, and analyze data." WHITE HOUSE REPORT, *supra* note 84, at 2.

152. This trend is particularly strong in young adult fiction. *See, e.g.*, Monica Rhor, *"Hunger Games" Spurs Dystopian Reading Trend,* Hous. CHRON., May 4, 2012, http://www.chron.com/life/article/Hunger-Games-spurs-dystopian-reading-trend-3535441.php; Lauren Sarner, *Dystopian Fiction, and its Appeal: Why Do Apocalyptic Portrayals of Existence Dominate Teen Shelves?*, NY DAILY NEWS, June 28, 2013,

surveillance technologies, setting urban sensors and cameras operating as tools of repression and stagnation rather than transparency and innovation. Smart city technologies, in this optic, are adversarial and secretive; in reality, they need not be. The goal of local governments, Internet of Things developers and urbanists should be to empower and engage citizens—to "bring them along for the technology ride."[153]

1.   Access

The more familiar the public becomes with the how, where, and why of data collection by smart city technologies, the more many individuals will trust such operations. Engendering trust will propel more productive discussions about technology, turning the focus to how smart city benefits can be maximized and privacy and civil liberty risks minimized. Individual access rights are critical drivers for establishing trust and support in new connected technologies, including smart cities.[154] They help ensure that smart city surveillance is *not* adversarial and secretive by empowering users to see for themselves what information has been collected about them. In addition to fostering a sense of cooperation and engagement with the data itself, individual access rights may also help ground policy discussions and proposals in fact-based scenarios, rather than speculations about possible worst-cases.

In the emerging market for the Internet of Things, businesses are already encouraged to provide individuals with reasonable access to personal information collected by connected devices in their homes, cars, and offices.[155] In a big data world, "[t]his means providing individuals with access to their data in a 'usable' format and allowing them to take advantage of third party applications to analyze their own data and draw useful conclusions (e.g., consume less protein, go

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http://www.nydailynews.com/blogs/pageviews/dystopian-fiction-appeal-apocalyptic-portrayals-existence-dominate-teen-shelves-blog-entry-1.1640750.

153. Polonetsky & Tene, *supra* note 150 (manuscript at 44).

154. Omer Tene & Jules Polonetsky, *Big Data for All: Privacy and User Control in the Age of Analytics*, 11 Nw J. TECH & INTELL. PROP. 239, 263–270 (2013).

155. CHRISTOPHER WOLF & JULES POLONETSKY, FUTURE OF PRIVCACY FORUM, AN UPDATED PRIVACY PARADIGM FOR THE "INTERNET OF THINGS" (November 19, 2013), http://www.futureofprivacy.org/wp-content/uploads/Wolf-and-Polonetsky-An-Updated-Privacy-Paradigm-for-the-"Internet-of-Things"-11-19-2013.pdf; Future of Privacy Forum, Internet of Things, Comments Before the Federal Trade Commission (January   2014),   http://www.futureofprivacy.org/wp-content/uploads/FPF-IoT-Comments_January-2014.pdf.

on a skiing vacation, invest in bonds).”[156] Providing access to usable personal information is mutually beneficial for consumers and organizations: by expanding the personal information ecosystem, layers upon layers of user-side applications are likely to emerge to utilize information.[157] Not only would consumers benefit by being able to see their own data, such access would also fuel the emergence of yet more innovative technologies to ease the friction of urban living.

In addition to turning personal information into a valuable joint resource[158] in which both smart city technology developers and urban citizens have a stake, individual access rights serve an important accountability function. Especially in an environment as opaque as the hyperconnected metropolitan bureaucracy, access rights inherently create a level of institutional transparency; if citizens can access their own information, they will also necessarily have a better sense of which agencies are responsible for controlling and securing it. Furthermore, useful access to information will help engage individuals, invite scrutiny of organizations’ information practices, and expose potential data misuse.

Individual access rights help engender public trust in smart city technologies, opening new pathways to transparency and accountability. To further stabilize the balance of power between urban stakeholders and ensure that smart city technologies remain mutually beneficial, smart cities should pursue data featurization[159] by providing the public usable access to personal information.

2. Data Featurization

Previous articles have argued the necessity of “featurizing” big data, by encouraging organizations to “share the wealth created by individuals’ data with those individuals.”[160] Featurization describes the practice of making data a consumer-side feature of products and services—for example, a fitness-tracker that collects its wearer’s heart rate, caloric intake, or sleep schedule may also deliver that information back to the manufacturer, but its principal purpose is to collect and use data for the *consumer’s* benefit, so that its wearer can improve her own life and well-being by, e.g., sleeping more, or

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156. Tene & Polonetsky, *supra* note 154, at 264.
157. *Id.*
158. *Id.* at 269.
159. *See* discussion *supra* Part III.A.2.
160. Tene & Polonetsky, *supra* note 154, at 264.

controlling her diet and exercise. This approach argues that not only should individuals be given useful, usable access to their information, they should also be able to engage with it for *their own* purposes.[161] Giving citizens the ability to use their data and to benefit from it firsthand, in tangible ways, is a critical step to ensuring public trust and support for smart city technologies. It also promotes a culture of innovation, data-driven decision-making, and civic participation.

In many smart cities, the marketplace for featurization is well underway.[162] While top-down, highly planned, and hyperconnected smart cities are still being built, the more common reality for the modern urbanite is to witness their city becoming "smart" through bottom-up services and products.[163] Citizens may never notice the technologies behind smart waste management systems, but they certainly see the culture of innovation and data-driven decision-making when their smartphone app connects them to real-time subway data, finds a parking space, tracks a lost bike, or allows them to summon city services to fill in a specific pothole.[164] Many smart city enterprises are already encouraging this sort of decentralized "DIY urbanism" through open data channels and contests.[165]

The more that smart city data is featurized—the more "dials and levers" are built into urban systems to allow individuals to engage with their data—the more city-dwellers will begin to regain agency and choice over their own data in the face of ubiquitous urban surveillance. So far, no functional equivalent to the "Green Button" and "Blue Button" initiatives launched by the Obama Administration, which let consumers freely and securely download and reuse their own smart metering and personal health records,

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161. *Id.*

162. *See* TOWNSEND, *supra* note 20, at 9.

163. *See Clever Cities: The Multiplexed Metropolis*, *supra* note 7. Top-down cities include Songdo, South Korea, "the world's largest experiment in urban automation, with millions of sensors deployed in its roads, electrical grids, water and waste systems to precisely track, resond to, and even predict the flow of people and material . . . a place that will 'run on information.'" TOWNSEND, *supra* note 20, at 24. Bottom-up cities include Amsterdam, whose Smart City program focuses on "collaborative models and creating insight/access to data for users." Ger Baron, *'Smartness' from the Bottom-up: A Few Insights into the Amsterdam Smart City Programme*, 2013 METERING INT'L, no. 3, 2013, at 98, http://amsterdamsmartcity.com/data/file/MeteringInternational_BottomUp_GB.pdf.

164. *See* CITY OF BOS., *supra* note 91.

165. TOWNSEND, *supra* note 20, at 226–30 (including, for example, "Summer of Smart," "Data Catalogue," "Apps for Demoracy," and the "BigApps" contests).

respectively, has surfaced in the smart city sphere.[166] A single "smart city button" may never appear, given the sheer scale and diversity of the information collected by smart cities and the large number of service providers involved. However, growth of such initiatives in more narrow sectors might provide a model for consolidating individuals' urban data trails into more accessible sets, which could be managed through easy-to-use dashboards. While the marketplace for using featurized data is already in place, the individual accessibility tools lag significantly.[167]

   Many of the smart city privacy risks discussed previously revolve around the consolidation of data and power in centralized government actors. Providing individuals with access to that data, in addition to transparent structures, could abate concerns about unfairness and inaccuracy.[168] Furthermore, by distributing access and power back to the urban masses, the featurization of privacy may also reintroduce competition and democratic impulses to the smart city, forces which often preserve privacy by leveraging such protections into a competitive advantage.

B. De-Identification

   The societal value ascribed to de-identified (also known as anonymized) data has become immense, especially in the era of big data.[169] Smart cities, which gather and process astronomical amounts of personal and non-personal information every day, have a particularly vested interest in the reliability of de-identified data.[170] Although re-identification techniques have increasingly strained de-identification, with reports of researchers successfully re-identifying

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166. Both efforts, as well as "Get Transcript" (for taxpayer records) and "MyStudentData" (for student loan information), are "My Data Initiatives" that intend to "empower Americans with secure access to their personal data and increase citizens' access to private-sector applications and services that can analyze it." WHITE HOUSE REPORT, *supra* note 84, at 13–14.

167. Tene & Polonetsky *supra* note 154.

168. *Id.* at 272–73.

169. Future of Privacy Forum, *supra* note 36. The FTC considers data to be reasonably de-identified when a company achieves "a reasonable level of justified confidence that the data cannot reasonably be used to infer information about, or otherwise be linked to, a particular consumer, computer, or other device." FED. TRADE COM'M, PROTECTING CONSUMER PRIVACY IN AN ERA OF RAPID CHANGE: RECOMMENDATIONS FOR BUSINESSES AND POLICYMAKERS 21 (2012), *available at* http://www.ftc.gov/sites/default/files/documents/reports/federal-trade-commission-report-protecting-consumer-privacy-era-rapid-change-recommendations/120326privacyreport.pdf.

170. Perera et al*., supra* note 34.

apparently anonymized information, "it would be a mistake . . . to conclude that it is always easy to re-identify data or that anonymization is not a useful, privacy-protective practice."[171] When properly secured, de-identification serves as an important protection of privacy concerns.[172]

While de-identification can no longer be treated as a "silver bullet," de-identified data sets still provide significant social utility with lowered privacy risks. Neighborhood-level survey data from modern cities, in aggregated and anonymized form, is already the foundation for the critical public data sets used to allocate billions of dollars in resources and funding not only locally but also on the state and federal levels.[173] Smart cities, with the radically more granular data available to them, can lay a foundation for an efficient and cost-effective economy.[174] Importantly, de-identified urban data also aids city planners and other researchers to study, test, and address the ramifications of mass urbanization, including issues like overcrowding, pollution, and crime.[175]

Moreover, public data comprised of non-private or de-identified information is the foundation of the open data projects and resources that spur a large proportion of today's bottom-up smart city apps and technologies.[176] The growing marketplace for public data-supported smart city apps presages even more widespread innovation.[177] Even in circumstances where providing individuals access to their personal information may not be feasible, the public would benefit from a de-identified data set incorporating such information as a way to furnish city-goers with some sense of engagement, reciprocity, and transparency.

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171. WOLF & POLONETSKY, *supra* note 155, at 8.

172. *Id.*

173. *About the American Community Survey*, U.S. CENSUS BUREAU, https://www.census.gov/acs/www/about_the_survey/american_community_survey/ (last visited Oct. 18, 2014).

174. *See* Russ Vanos, *Economic Development Through Innovation, Collaboration & Smart Grid Technology*, MEETING OF THE MINDS (May 12, 2014), http://cityminded.org/economic-development-through-innovation-collaboration-smart-grid-technology-10825.

175. BUILDING RESILIENT REGIONS, *Big Data and Urban Planning*, INST. GOV'T STUD. UNIV. CAL. BERKELEY (Jan. 22, 2013), http://brr.berkeley.edu/2013/01/big-data-and-urban-planning/.

176. See, for example, NYC Open Data, which makes over 1100 public datasets freely available and serves as the platform for the NYC BigApps competition, which "empowers the sharpest minds to solve New York City's toughest challenges through technology, data, and collaboration." *New York City Restaurant Inspection Results,* NYC OPEN DATA, https://data.cityofnewyork.us/ (last visited Oct. 18, 2014).

177. *Id.*

When deployed with appropriate technical, physical, and administrative safeguards, anonymization is a valuable tool in restoring some of the balance between what smart city governments know about their citizens and what those citizens know about their governments as well as themselves. De-identification may also provide a middle ground between forcing institutions to release too much personal information and releasing none.

C. Enhanced Transparency

While big data promises great rewards, like any far-reaching technological advancement, it has produced unintended, negative externalities. Big data's capacity to draw useful new inferences out of otherwise inscrutable stockpiles of data has enabled radical advancements in predictive, adaptive technological innovations.[178] At the same time, however, big data analytics can be used to discriminate against individuals and groups, to justify paternalism, and to contribute to data overload and institutional opacity.[179] Even perfectly innocuous, accurate data may give rise to "inaccurate, manipulative or discriminatory conclusions."[180]

If big data is more than the sum of sizable raw data, so, too, must transparency become more than just static inspection of raw data. Previous papers have proposed that "[i]n order to delimit the zone of ethical data analysis . . . organizations reveal not only the existence of their databases but also the *criteria* used in their decision making processes."[181] One of the fundamental principles of informational privacy, after all, is to prevent the creation of secret databases.[182] Further, while organizations would not be asked to disclose their proprietary algorithms, it is nevertheless critical that citizens understand how and to what effect such organizations use their data. If not, even the provision of individual access to data may ring hollow. In smart cities, occupied as they are by government actors, principles of fairness and due process loom particularly tall; accordingly, so does the "mandate that individuals [be] informed of the basis for decisions

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178. WHITE HOUSE REPORT, *supra* note 84, at 39.

179. *See supra* Part II.

180. Omer Tene, *Big Data for All*, CONCURRING OPINIONS (Sept. 20, 2012), http://www.concurringopinions.com/archives/2012/09/big-data-for-all.html.

181. Tene & Polonetsky, *supra* note 154, at 270 (although disclosure should be "subject to protection of trade secrets and other intellectual property law").

182. *Id.* at 267 ("From its inception, information privacy law has been modeled to alleviate this concern, which arose in the Watergate period in the United States and the Communist era in Eastern Europe when secret databases were used to curtail individual freedoms.").

affecting their lives, particularly those made by machines operating under opaque criteria."[183]

If enhanced transparency is to become a reality, however, compliance with it must also mean more than simply checking a box. In the age of the Internet of Things, as data flows become more and more complex, it will become more and more difficult for individuals to monitor and enforce privacy compliance.[184] Where similar transparency concerns have percolated through industry and regulatory bodies, commenters have suggested that automated accountability mechanisms be designed to determine how personal data is used and whether uses conform to established policies.[185] When such mechanisms identify improper uses, such as denial of credit based on religious or political beliefs, they would notify responsible parties and trigger appropriate action.[186] For example, information within a database could be "tagged with its provenance and logs of transfers and uses."[187] Ironically, this could mean repurposing the very processes that make big data analytics so effective—i.e., tracking, quantifying, and interpretively analyzing complicated masses of dynamic data—to ensure that big data results remain transparent and compliant.

Big data is inherently an interpretative process, albeit one "in which one's identity and perspective informs one's results."[188] As such, smart cities powered by big data will always have to contend with error, inaccuracy, and bias.[189] Enhanced transparency mitigates those risks, under Louis Brandeis' oft-quoted principle that sunlight is "the best of disinfectants."[190] In a big data-driven smart city, with its millions of stakeholders and significant social and political pressures, "[w]e trust that if the existence and uses of databases were visible to the public, organizations would be more likely to avoid unethical or socially unacceptable uses of data."[191] *Without* enhanced transparency into decisional criteria, however, smart cities may fall back into the dystopian optic, with all their idealistic promise reduced

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183. *Id.* at 271.

184. WOLF & POLONETSKY, *supra* note 155.

185. *Id.*

186. *Id.*

187. *Id.*

188. Tene, *supra* note 180.

189. *Id.*

190. Louis D. Brandeis, *What Publicity Can Do*, HARPER'S WEEKLY, Dec. 20, 1913, at 10.

191. Tene & Polonetsky, *supra* note 154.

to "Kafkaesque machinery that manipulates lives based on opaque justifications."[192]

CONCLUSION

Smart cities contain worlds of potential. They hold promise of urban utopia; at the same time they also carry the seeds of a dystopian panopticon. The technology giving life to either option is now firmly within our grasp, as cities and citizens grow ever more responsive to our information-driven society. Nevertheless, those technologies necessitate cameras and sensors throughout the urban landscape, constantly monitoring and mining city-dwellers' personal behaviors and tendencies. Ubiquitous urban surveillance demands equally robust privacy protections, in order to preserve the balance of power between the people and their city governments, and to ensure that citizens' data does not become a tool of inequality and oppression.

By 2050, the United Nations estimates about seven in every nine people on the planet will live in cities.[193] In order to prepare themselves for such a challenge, cities all around the world are turning to networked technology and big data analytics to help measure and adapt to upcoming changes. They are in the process of transforming themselves into sustainable, optimized, hyperconnected smart cities. As they do so, however, it is worth recalling the lessons of the first wave of urban renewal, which failed to live up to its own promise and expectations. One of the critical missteps at that time was a failure to respect the diverse needs and patterns underlying urban life. Today, a failure to address privacy risks in constructing smart cities could lead to yet another flashy, substanceless boom – and then yet another collapse. It is not yet clear to which brave new world smart cities will lead us. Yet, while big data and smart city technologies may create new privacy risks, they also empower citizens in new ways to restrain and manage these risks while at the same time leveraging new technologies to increase efficiency and welfare.

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192. *Id.* at 243.

193. Edith M. Lederer, *UN Predicts Near Doubling of City Dwellers by 2050*, ASSOCIATED PRESS, Dec. 9, 2013, http://bigstory.ap.org/article/un-predicts-near-doubling-city-dwellers-2050.