Developing the Operational City: Sidewalk Labs & Toronto's Eastern Waterfront

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> What would a city look like if you started from scratch in the internet era —if you built a city from the internet up?
>
> —Dan Doctoroff, Founder of Sidewalk Labs

In social media and the popular press, there is much discussion over the City of Toronto's decision to partner with Google on their Eastern Waterfront development, however, there has not been enough scholarly research on its long-term implications. First, this public-private partnership signals a new model for urban design professionals. Second, intelligent infrastructure will be harvesting citizen data continuously and autonomously twenty-four hours per day. Google will build on its reputation as the world's largest search and data aggregation company by layering the city with a ubiquitous wireless network on top of city services, forming an informational stack that will invisibly orchestrate communication, economics, and energy. Artificial intelligence software will analyze the resultant mass of citizen data, and use it to automatically inform decisions that will shape future city services. Those analytical feedback loops will create an operational city, one where cars drive themselves and smartphones know what residents want and where to find it – all in real time. Is this the future vision for our cities?

Before we can safely answer that question, we need to ask, who or what is behind the smartness initiative? Large IT corporations, such as Cisco, IBM, Siemans, and others, are ambitious to see their own proprietary software deployed throughout the urban environment without considering the cost to citizens. While in the past, we have written about the primarily positive affordances of network technologies to enable participatory practices, in this paper, we want to focus on some of the more controversial aspects of smart cities, so that as architects, planners, and educators, we can insert ourselves into the discussion and shape the conversation toward greater public participation.

OPERATIONAL CITIES

Whether for increased efficiency or sustainability, there has been a move toward greater command and control in everyday life. During the 1980s IBM and Microsoft effectively colonized the work environment by introducing a suite of computational programs and methods to corporations, which was soon followed by the fully networked office. The very nature of computational exchanges allows for the monitoring of each and all actions: regulating employees' time, spying on their correspondences, doing cost-benefit analysis, along with more traditional accounting.

Having successfully conquered the office territory, technology conglomerates, including Google among many others, began searching for new markets to colonize. Although cities have been competing for the campuses of mega corporations by offering tax breaks (most recently to Amazon), Alphabet has advanced those ideas further by actively seeking urban environments to implement its products. While planners such as myself have proposed test bed situations to obtain more accurate feedback, it was always with the intention of working with existing universities, or innovation areas, such as Issy in France or Zaragoza in Spain. However, building a new city from the internet up is a different project. How are we to better understand what is being proposed?

Benjamin Bratton offers a theoretical perspective called The Stack. For Bratton, The Stack describes the global information economy, in other words, the digital market economy. For geographers Kitchin and Dodge, this formation is characterized as *code/space* or "when software and the spatiality of everyday life become mutually constituted, that is, produced through one another." Code/space is increasingly pervasive in everyday life—ranging from airport check-in kiosks to self-service checkout lanes at grocery stores to mobile apps such as Uber. What distinguishes code/space is that this stack of ubiquitous of information and communication technologies [ICT] is actively responding and shaping physical space vis-à-vis feedback loops of AI software and other non-human agents—creating what we are calling the Operational City.

For the purposes of this paper, we consider the Operational City as a way to understand networked urbanism more generally, and the Google's Eastern Waterfront specifically, as well as how technology conscribes, shapes, and disciplines its users within the urban environment. As a conceptual framework, what we are delineating is an all-encompassing urban computation system, a responsive matrix that includes all the infrastructural elements of the city—its utilities, streets, public transportation, information and communication systems, in addition to citizens/users defined through self-quantification. Previously, Foucault argued that governance is expressed and configured through the specific technologies and techniques with which it produces its own subjects and objects. In the same way, code/space is an effect as much as a

Figure 1: Toronto Eastern Waterfront Aerial View 2018. Image courtesy of Sidewalk Labs

cause of how certain algorithms and machines organize urban bodies over time. If, according to Foucault, the city is a social construction of everyday life, then how does the Operational City reflect that? In a smart city, the algorithm effectively acts as the state—in that the state functions autonomously and is thus no longer subject to the will of its citizens.

DATA & DATAISM

> Facebook's sales motto is 'build big communities and you will own them.'
>
> —Scott Galloway

Our principal concern with Toronto's Eastern Waterfront is the use and protection of personal and environmental data. Sidewalk Lab's proposed wholesale embedding of environmental sensors, allowing for twenty-four-hour surveillance of citizens, has outraged citizens. At Waterfront Toronto's citizens meeting, residents expressed two main concerns: [1] that the reliance on data for decision-making was too heavy and [2] that those data decisions were perceived to be infallible. Those concerns are not insignificant; they need to be heeded. While Harrison et al. defined a *smart city* as an "instrumented, interconnected and intelligent city. In this definition, *instrumented* refers to capturing realtime, real world data through the use of sensors; *interconnected* means integrating this data/information into a computing platform that distributes it appropriately to city services; *intelligent* refers to complex analytics, modeling, optimization to make better decisions." Needless to say, what has been left out of this definition is that the automated practice of geo-tagging makes sensor data particularly difficult to anonymize.[1] Further, the Internet of Things reveals unexpected inferences through the cross-referencing of data, known as "sensor fusion." That aspect makes each IoT device important as a policy matter, because the data can be used to make decisions about housing, health insurance, employment, credit—with the possibility of creating new forms of racial, gender or other discrimination against protected classes.

Sensor fusion contributes to an ongoing process of quantifying urban residents. While the US census has existed for over a hundred years, sensor fusion is relatively new. The smartphone, the most ubiquitous intelligent device, incorporates sensors such as the accelerometer, compass, and GPS, yet the high cost of these sensors formerly prevented them from being used indiscriminately in the environment. That has changed. The recent affordability of sensors allows their widespread use in machines, devices, and transportation—and even on individuals (an example is the Apple Watch). Increasingly, inexpensive wireless sensors will be embedded in the urban environment, creating sophisticated large-scale sensor networks. Within these networks, smartphones will effectively act as wireless hubs for other devices, connecting the IoT (also known as the Internet of Everything or Cloud of Things) at the urban scale. Autonomous vehicles equipped with artificial intelligence

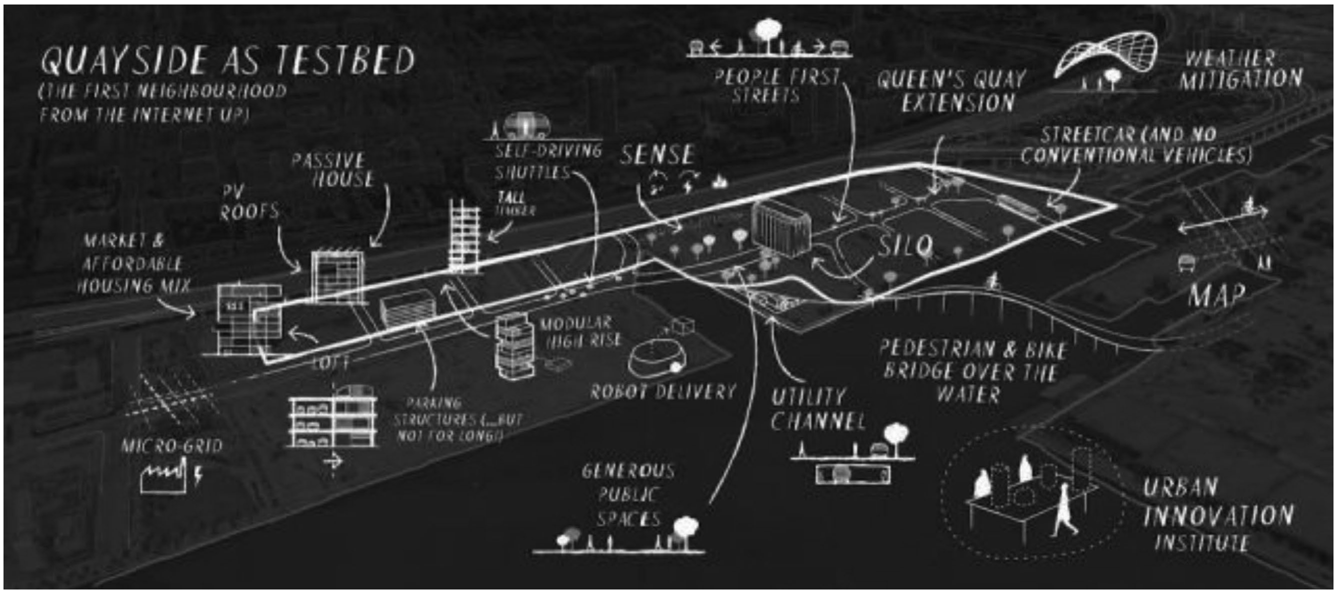

Figure 2: Toronto Quayside Test Bed 2017. Image courtesy of Sidewalk Labs.

software and embedded sensors are one such example of sensor fusion: they are capable of perceiving other automobiles, pedestrians, and road position, in addition to intra-car communication, and respond in realtime. What is the concern? The simple process of writing code for data processing and analytics allows for filters with built-in biases.

Before developing that important argument, we offer some background on how and when discrimination plays a role in the allocation of public and private resources and opportunities. Although this discussion focuses on everyday human-made decisions, the same biases can be written into algorithms with automated decision-making. Here, we wish to emphasize the practice of black boxing the decision-making, which is to say, the criteria used to make decisions is non-transparent.

Sociologists Pager and Shepherd have identified the major research findings and debates on discrimination in two domains related to smart cities: [1] employment practices and [2] housing markets. (Other areas in the literature include health insurance markets, but space does not permit us to go into all of them.)[2] First, from the domain of employment: Several studies have consistently found strong evidence of racial discrimination based on audit studies of hiring decisions with estimates of white preference ranging from 50% to 240%.[3]

> In a 2004 study, the researchers mailed equivalent resumes to employers in Boston and Chicago using racially identifiable names to signal race (for example, names like Jamal and Lakisha signaled African Americans, while Brad and Emily were associated with whites).[4] White names triggered a callback rate that was 50% higher than that of equally qualified black applicants creating racialized barriers to labor market entry. Further, their study indicated that improving the qualifications of applicants benefited white applicants but not blacks, thus leading to a wider racial gap in response rates for those with higher skill level.[5]

Second, from the domain of credit markets found that with prospective homebuyers, minorities not only experience less assistance with financing, but also were frequently guided into less wealthy communities and neighborhoods with a higher proportion of minority residents.

> Residential segregation by race remains a salient feature of contemporary American cities. Indeed, African Americans were as segregated from whites in 1990 as they had been at the start of the twentieth century, and levels of segregation appear unaffected by rising socioeconomic status.[6] Although segregation appears to have modestly decreased between 1980 and 2000 blacks (and to a lesser extent other minority groups) continue to experience patterns of residential placement markedly different from whites.[7]

Available evidence suggests that blacks and Hispanics face higher rejection rates and less favorable terms in securing mortgages than do whites with similar credit characteristics report that blacks pay more than 0.5% higher interest rates on home mortgages than do whites and that this difference persists with controls for income level, date of purchase, and age of buyer.[8] Further, researchers found that "even at the highest income level, blacks are almost three times as likely to get their loans from a subprime lender as are others."[9]

**IF YOU ARE NOT PAYING,
YOU'RE THE PRODUCT BEING SOLD**

Figure 3: Originally posted by MetaFilter user blue_beetle at 1:41 PM on August 26, 2010.

Summarizing the findings from the two domains of employment and housing markets, we find that everyday discrimination continues to persist—even with legislation that outlaws it. However with AI, racial bias can be written into the decision-making algorithms—effectively making the process even more opaque. With sensor fusion in particular, GIS coordinates can be instrumentalized to pinpoint and filter out particular applicants by way of their address, called geo-blocking. This allows for geographic profiling, so that particular neighborhoods, ethnicities, or sexual orientations can be automatically filtered, given differential treatment and/or rejected. In a smart city, it is conceivable that agencies could also access medical records databases, along with public records related to schools, courts, police, and government assistance programs. For a price, private businesses or organizations could assess an individual's background by neighborhood including income level, safety, or health risks, such as the location of environmentally toxic sites, and then use that information to deny medical insurance or other health services.

Sensor fusion also poses a significant challenge to historical notions of justice. While "innocent until proven guilty" was accepted as axiomatic, the practice of data-driven profiling by domestic law enforcement now utilizes predictive methods. According to a study by Julia Angwin, et al., computational models of "actuarial justice" and "predictive policing" draw correlations between specific risk factors and the probability of future criminal action.[10] Similar to Amazon's proactive profiling "If you like chocolate ice cream, you might like, etc." which may be useful for promoting music or books, but it does not serve so well for justice. Other problems with sensor fusion arise when datasets are combined. In New York City, Palantir software merges data from disparate city agencies and external organizations, enabling police to collate information about suspects, targets, and locations.

What is even more a matter for concern is that courts and police make decisions based on proprietary technologies with significant issues: incomplete datasets, high error rates, demographic bias, and discrepancies in administration.[11] According to informatics researcher Shannon Mattern, "studies have shown that criminal justice management software with machine bias such as Northpointe's and others dramatically overestimate the likelihood of recidivism among black defendants. Biometric instruments, such as facial recognition software and fingerprint and retina scanners can misread people of color, women, and disabled bodies…All of this is to say that the algorithmic regulation of data should make us wary of new initiatives."[12]

If data is perceived as infallible, then what recourse is available for citizens to redress mistakes? Both residents and urban planners are concerned that they will have to rely on Sidewalk-developed software to gain access to public services, and the data gathered from everyone will influence long-term planning and development.[13] Sidewalk decisions will be automated, that is to say without looking at context —the socio-cultural environment behind the data. Mattern cautions that end users won't know which agencies supplied the underlying information and how their interests (or biases) might have shaped data collection. Neither can they ask questions about how social and environmental categories are operationalized in the different data sets. They won't be able to determine whether the data reinscribes historical biases.[14] According to the *New York Times*, by "extending the surveillance powers of one of the world's largest technology companies from the virtual world to the real one raises privacy concerns for many residents…[Planners] caution that, when it comes to cities, data-driven decision-making can be misguided and undemocratic."[15] With data analysis, there is no consideration of context, no opportunity for expression or deliberation or debate. *Data decides*. In Sidewalk Labs' scheme, residents provide (unpaid) feedback about the products they use—but without gaining any political agency in return.

CONCLUSION: POLICY AND REGULATION

The increasing power of technology corporations in determining how we live our lives—how we engage, who talks to whom, and who is allowed to play—are moving from the internet to the physical world. This has serious consequences for urban governance. The collection and assembling of this data/information and the use of it to predict and manipulate future choices may mean that we become unable to distinguish the menu of restricted options from our own ideas.[16] Considering the emerging data landscape, it would make sense to define network technologies—from services that can verify our identity, to new payment systems, to geo-location sensors—as physical infrastructure or utilities. In addition, citizen review boards are necessary to secure transparency in decision-making processes. This step is essential to ensure that everyone, regardless of income level or race, can access these services on the same, nondiscriminatory terms.

In conclusion, the rhetoric of "smartness" confers an ideology of efficiency, optimization, and safety. Sidewalk Labs perpetuates those myths, including the infallibility of big data to make accurate decisions.[17] While urban planners rely on data to better understand the city and its residents, their education in the social sciences prepares them to conceptualize data as only one part of the planning process. It is through exposure to the social sciences that interpretive critique is mastered; planners are trained to reduce bias through their methodologies, including the forming of hypotheses, qualitative methods, and peer review. Thus, there is warranted concern about smart cities among professionals and laypersons alike related to the use and operations of data. What appears to be an emphasis on greater efficiency and control at the user end is actually veiling the commercial practice of personal data mining on the provider end. Users perceive a gain in control but they are in fact being constantly monitored. "The extent, precision, and speed of this data gathering is unprecedented," according to Internet theorist Felix Stalder.[18] As our notions of access and mobility are being reconfigured, so too is individual privacy. Concern about the surveillance of individual and collective actions including racial profiling, communications, and movements by domestic security forces such as the NSA is warranted, both here and abroad.[19] Thus just as Haussmann reconfigured the street infrastructure of Paris for increased political control, so too networked sensor tracking has the potential to restrict citizens in a similar way. As evidenced by geoblocking, infrastructure has multiple dimensions and may be repurposed for different objectives. While networked infrastructure can increase access to services, it can also restrict it.[20]

Given today's slippery redefinitions of citizenry and urban sovereignty, what has governance done to address these challenges by tech giants? While Europe has stepped up their regulations GDPR, for the residents of Toronto and other North American cities, what can they rely on? Will the choice be between human rights or end-user agreements?[21]

While data can assist planners in understanding cities better, it seems clear that the larger issue is that a city is not fundamentally a technological problem. Data analysis is useful for the optimization of resources, nonetheless, we must insure that those very same resources are equally available for all urban residents. A city applies technologies to be operational, but ultimately people create technology. And while data is important, no less so, are our historical rights to shape the future of our communities. In that context, the more important question is not, what an internet city would look like, but what a *user-generated* city would look like? In answering that question, we must ensure that any ongoing developments lead to cities that are more humane, not less.

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ENDNOTES

1. Daniel L. Doctoroff, "Reimagining Cities from the Internet Up," *Medium*, November 30, 2016, https://medium.com/sidewalk-talk/reimagining-cities-from-the-internet-up-5923d6be63ba.

2. The author was a U.S. Delegate for the Consulate General of France in San Francisco Smart & Digital Cities Tour in 2013. See "Smart and Digital Cities Tour: A Delegation of American Experts Invited to Attend Paris Digital World Festival Futur-en-Seine in June," Cision PR Newswire official website, June 10, 2013, https://www.prnewswire.com/news-releases/smart-and-digital-cities-tour-a-delegation-of-american-experts-invited-to-attend-the-paris-digital-world-festival-futur-en-seine-in-june-210884131.html.

3. This model, informed by the logic of the multilayered or "stacked" protocol structure in which network technologies operate within a modular, vertical order, regulated by feedback loops, offers a comprehensive image of emerging smart cities.

4. Rob Kitchen and Martin Dodge, *Code/Space: Software and Everyday Life* (Cambridge, MA: MIT Press, 2011).

5. Scott Galloway, *The Four: The Hidden DNA of Amazon, Apple, Facebook* (London: Penguin, 2017), 165.

6. A data commissioner in Hamburg, Germany, insisted on inspecting the hard drive of one of Google's mapping cars to make sure that they were only taking photos only of streets and buildings. What the data commissioner subsequently discovered was that Google was also downloading data from open Wi-Fi networks, which is to say, personal information, as its survey cars went down the streets. Google denied it was doing this. See "Why Your Cellphone Could be Called a 'Tracker,'" NPR's *Fresh Air* podcast, hosted by Terry Gross, audio, 16:00, September 6, 2012: https://www.npr.org/2012/09/06/160627856/why-your-cell-phone-could-be-called-a-tracker.

7. C. Harrison et al., "Foundations for Smarter Cities," *IBM Journal of Research and Development* 54, no. 4 (2010): 1-16.

8. According to Dan Work, Associate Professor, Civil & Environmental Engineering & Computer Science, Vanderbilt University.

9. Devah Pager and Hana Shepherd, "The Sociology of Discrimination: Racial Discrimination in Employment, Housing, Credit, and Consumer Markets," *Annual Review of Sociology* 34 (2008):181-209, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2915460/.

10. H. Cross et al., *Differential Treatment of Hispanic and Anglo Job Seekers: Hiring Practices in Two Cities* (Washington, D.C.: Urban Institute Press, 1989). Also see: Margery Austin Turner, Michael Fix, and Raymond Struyk, *Opportunities Denied, Opportunities Diminished: Racial Discrimination in Hiring* (Washington, D.C.: Urban Institute Press, 1991); and Michael Fix, Raymond J. Struyk, eds., *Clear and Convincing Evidence: Measurement of Discrimination in America* (Washington, D.C.: Urban Institute, 1993).

11. Marianne Bertrand and Sendil Mullainathan, "Are Emily and Greg More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination," *American Economic Review* 94, no.4 (2004): 991–1013.

12. Pager and Shepherd, "The Sociology of Discrimination."

13. Douglas S. Massey and Nancy A. Denton, *American Apartheid: Segregation and the Making of the Underclass* (Cambridge, MA: Harvard University Press, 1993).
14. Pager and Shepherd, "The Sociology of Discrimination."
15. Refer to: Stephen Ross and John Yinger, "Does Discrimination in Mortgage Lending Exist? The Boston Fed Study and its Critics," in Margery Austin Turner and Felicity Skidmore, eds., *Mortgage Lending Discrimination: A Review of Exisiting Evidence* (Washington, D.C.: Urban Institute, 1999): 43–83. See also: Melvin Oliver and Thomas Shapiro, *Black Wealth, WhiteWealth: A New Perspective on Racial Inequality* (New York: Routledge, 1997), 142.
16. Oliver and Shapiro, 197.
17. Julia Angwin et al., "Machine Bias," *ProPublica*, May 23, 2016.
18. Robert Brauneis and Ellen P. Goodman, "Algorithmic Transparency for the Smart City," *Yale Journal of Law and Technology* 103 (2018), http://doi.org/cncv. Also see: Sarah Brayne, "Big Data Surveillance: The Case of Policing," *American Sociological Review* 82, no. 5 (2017): 977-1008, http://doi.org/gcsq6p19.
19. Shannon Mattern, "Databodies in Codespace" *Places Journal* (April 2018), https://placesjournal.org/article/databodies-in-codespace/. Virginia Eubanks explains, "Marginalized groups face higher levels of data collection when they access public benefits, walk through highly policed neighborhoods, enter the healthcare system, or cross national borders. That data acts to reinforce their marginality when it is used to target them for suspicion and extra scrutiny. Those groups seen as undeserving are singled out for punitive public policy and more intense surveillance, and the cycle begins again. It is a kind of collective red-flagging, a feedback loop of injustice." Virginia Eubanks, *Automating Inequality* (New York: St. Martin's Press, 2017), 6-7. See also: Shoshana Amielle Magnet, *When Biometrics Fail: Gender, Race, and the Technology of Identity* (Durham: Duke University Press, 2011); Simone Browne, *Dark Matters: On the Surveillance of Blackness* (Durham: Duke University Press, 2015).
20. Sensor data is particularly difficult to anonymize and sensors may be used for many purposes beyond their original use or context. In addition, the *Internet of Things* [IoT] reveals unexpected inferences through the cross referencing of data. This aspect makes each IoT device important as a policy matter, because the data can be used to make decisions about insurance, employment, credit, housing—with the possibility of creating new forms of racial, gender or other discrimination against protected classes. See Scott Peppet, "Regulating the Internet of Things: First Steps Toward Managing Discrimination, Privacy, Security, and Consent," *Texas Law Review* 93, no. 1 (2014).
21. Mattern, "Databodies in Codespace."
22. During its first two years in operation, Sidewalk Labs looked at 152 places in the United States and several others around the world for a site to begin building cities of the future. See Ian Austen, "City of the Future?" *New York Times*, December 29, 2017.
23. Thanks to Professor Jean Pierre Protzen for forwarding "Data," *Neue Zürcher Zeitung*, December 8, 2017.
24. Also known as scientific rationalism.
25. Felix Stalder, *Between Democracy and Spectacle: The Front-End and Back-End of the Social Web in the Social Media Reader* (New York: NYU Press, 2012), 250.
26. While it is understandable for urban planners to collect and model data to understand the complex interactions of a city, this understanding would not apply to how repressive governments using those very same methods of data collection to discipline urban residents.
27. T. F. Tierney, *The Public Space of Social Media* (London: Routledge, 2013).
28. Benjamin H. Bratton, *The Stack* (Cambridge, MA: MIT Press, 2011), 9.