What is urban tech? Definitions, aims, and ethical tensions

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1. Throughout history the design, construction, operation, and maintenance of cities has both drawn on and driven developments in civil, mechanical, and electrical engineering. These fields, and their related design and planning fields—architecture, urban design, and urban planning—still make up most of what we think of as the domains of knowledge that shape the built environment.

2. Computerization, however, has changed everything. Since the 1960s, information and communications systems engineering has created capabilities that changed how all kinds of organizations function. This has included urban governments and the many companies and NGOs that drive urban economies and perform essential urban functions. Yet our theories of how cities work, our conception of how engineering shapes them day-to-day and over the long-term, and our narratives about how this connects to outcomes that matter in people's everyday lives remain woefully underdeveloped. Few of the professionals who shape the built environment even really understand the breadth, complexity, dynamism, and power of new digital urban infrastructure.

3. Meanwhile, the sheer volume of information systems engineering happening in and acting on the built environment and inhabitants of cities is growing exponentially. 'Urban tech'—a growing range of technical, business model, and behavioral innovations that have emerged over the last decade—are information systems-based products and services that claim to improve or expand on existing solutions to the problems of city management and city life. Urban tech is a hybrid. It lives at the intersection of markets and mayors' offices. And it cuts across existing disciplines—civil and environmental engineering, information systems, and urban planning—to holistically address complex problems at an urban scale.

4. This discussion paper explores the emerging territory of urban tech. First, it reviews *definitions* of urban tech, to develop a consensus view of what the field covers—the who, what, when, and where or urban tech. Second, it attempts to summarize the shared *aims* of urban tech. This effort is more of a proposition, extrapolating from the stated goals of urban tech practitioners and advocates. Finally, the most speculative part of the paper frames a set of open questions, tensions, and dilemmas dealing with the *ethics* of urban tech. For while we know technology has always been an essential part of urban success, it has also been a tool of oppression, exclusion, and outright destruction of cities as well.

Definitions

5. Hungarian engineer Karl Ereky coined the term "biotechnology" in 1919. But it wasn't until 1980, when *The Wall Street Journal* popularized the contracted version, "biotech", in its coverage of a wave of recombinant DNA startups, that the term really caught hold. Since then, the etymological formula of appending "-tech" has been widely employed not only by journalists by investors and entrepreneurs to identify emerging technology sectors. For instance, the use of *cleantech* (sustainable energy, water, and waste processing), *medtech* (medtech devices and diagnostics), and *edtech* (both distance-learning and classroom tools) came into wider use around 2000 and spread at a steady pace, as measured by the Google Books Ngram Viewer which tracks the appearance of terms in English language books. (Figure 1)

6. However, *urban tech* was all but unknown before 2010, although a handful of scattered use of the phrase can be found in the late 1990s and 2000s, in contexts unrelated to venture investing. Since then the term has enjoyed a rapid increase in use, similar to, though not nearly as intense as other more highly-capitalized sectors such as *fintech* (financial software and services) that emerged during the same period (Figure 2). The continued growth in use frequency of "urban tech" is likely attributable to its promulgation by a number of influential individuals. From 2013 to 2015, angel investor Shaun Abrahamson, the founder of venture fund Urban.Us, wrote a number of widely circulated pieces for the tech investor and urban philanthropy communities that used the term.[1,2] From 2018 to 2020, Richard Florida—a noted academic, author, and advisor to city leaders—published several quantitative assessments of private sector investment in urban tech startups that drew attention to these new capital inflows.

7. Urban tech's more modest success as a meme has much to do with its more modest total addressable market (TAM) compared to edtech, medtech, and even fintech. More importantly, however, the scope of these more widely-used neologisms is narrower and fairly intuitive. "Urban tech" doesn't explain itself so readily.

8. What exactly does "urban tech" encompass? To shed light on this question, I surveyed a sample of published definitions of the phrase "urban tech". These were sourced from industry analysts' reports, academic papers, and government policy documents. They reveal several salient features that seem to distinguish urban tech from: a) conventional engineering and design domains that deal with urban systems like civil engineering, architecture, and urban planning; b) digital government and management information systems in government as it has been practiced for the last half century; and, c) the smart cities movement, as it has been understood for the last decade or so, which to a large extent a vision for combining a) and b). In my view, five themes seem to define what urban tech is, and what it is not.

9. **Urban tech seeks scale.** Perhaps the most common element among urban tech definitions is the theme of scale. For instance, New York City's Economic Development Corporation states:

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[1] "Smart Cities: Opportunities for Startups," Gigaom, https://gigaom.com/report/smart-cities-opportunities-for-startups/ (site discontinued, document available in *Internet Archive* https://web.archive.org/web/20160310030550/https://gigaom.com/report/smart-cities-opportunities-for-startups/)

[2] Shaun Abrahamson, "Urban Tech Startups and The Cities of the Future," *Knight Foundation,* March 31, 2015, https://knightfoundation.org/articles/urban-tech-startups-and-cities-future/

"[Urban tech] encompasses innovations and solutions that directly address the challenges posed by urbanization, faced by government, businesses, and citizens as urban systems grow. It seeks new solutions for producing our food, delivering water, and managing waste; solutions that get us moving; that affect the places we sleep, live, study and work; and that help inform and support citizens and service providers, at city scale.[3]"

10. This ambition is widespread in venture capital-backed sectors—the investment model depends upon a small number of portfolio companies producing extraordinary returns. And having a meaningful impact on an urban problem means operating at the scale of an entire city or group of cities. However, there is a more subtle aspect to urban tech's need for scale—many of the solutions require large numbers of participants, or to capture entire systems, in order to produce valuable results. This is, at least in part, because of the network effects involved in the production of large datasets and machine learning techniques used to generate value from them.

11. **Urban tech creates extraordinary value through orchestration.** The technical ambition of the smart cities movement was instrumentation and control—everything a sensor, everything an actuator. But this vision of total mechanical automation of existing models of control often stopped there. The degree of integration among systems was under-theorized. Urban tech's ambitions of "orchestration", as I call it, goes a step further, and seeks the fully coordinated, *predictive* management of the built environment and human activity. In contrast to smart cities' approach grounded in incremental optimization of existing processes and structures, urban tech visions and solutions often come at problems from the other direction—a baseline assumption of radical restructuring of flows (of energy, material, and information and associated value) through deep and persistent cross-linking of many systems.

12. **City dwellers drive urban tech**.[4] The smart cities movement primarily focused on the application of enterprise information technologies to the affairs of local government, utilities, and infrastructure operators. The momentum behind urban tech comes from consumer markets. Urban tech creates value first by solving problems for people, and only secondly for organizations.

13. Take mobility-as-a-service (MaaS) architectures, for instance, where in the name of orchestration different transportation networks are linked together into a single user experience. The goals are societal and organizational—reducing carbon emissions, expanding mobility for all, and boosting the fiscal health of transit operators. But the means are focused on people. The complex orchestration of ticketing, payment, and dispatching that makes MaaS work is hidden from view. It creates enormous demands on organizations, with multitudes of systems interacting in real-time and sophisticated models of physical assets, urban terrain, and human behavior to work properly. As Jean-Cluade Bolay and Abigaïl-Laure Kern write, "urban technology would thus primarily be a human technology, in its deepest sense, created by humans for their development as well as their material, social, sanitary, and even spiritual wellbeing."[5]

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[3] NYCEDC, *Urbantech NYC Digital Brochure 2019,* https://edc.nyc/sites/default/files/2019-07/Urbantech-NYC_Digital-Brochure-2019-vF-1.pdf.

[4] We'll use the term *city dweller* throughout here as a more inclusive term than "citizen", as many of the people who live in cities and must be served by urban tech may lack official status as citizens. It also supersedes "user", as many of the people that engage with urban tech are co-producers or have other important roles beyond usage.

[5] Jean-Claude Bolay & Abigail Kern, "Technology and Cities: What Type of Development is Appropriate for Cities of the South?" *Journal of Urban Technology* 18, no. 3: 25-43.

14. The end user focus of urban tech is so pronounced that some investors have gone so far as to write government out of the picture entirely, envisioning urbantech as an entirely consumer technology. As the *Urbantech Investor Playbook*, published by angel investment group Urban.Us, an early evangelist of the term, writes in 2019: "Urbantech describes startup technology companies that directly improve city life and cities' sustainability. Unlike smart cities, urbantech does not primarily sell to city governments, but rather consumers and businesses." This is a provocative view, and focuses our attention on the innovation gap between e-government services and digital services in the private sector. But it is too limiting. There are plenty of examples where governments are deploying high-quality digital services that meet or exceed market standards.

15. **Urban tech is big business, but also a thoroughly "social-ish" enterprise.** In October 2018, Richard Florida's Creative Class Group, a consultancy, reported that after a combined $76.8 billion in investment over a 3-year period, "the urban tech sector attracts more venture capital funding than major high-tech fields like artificial intelligence, biotech and cryptocurrency." Some 22 percent of all venture capital invested globally during the 2016-2018 period, the report claimed, went into urban tech.[6] While the vast bulk of these funds were concentrated in just two sectors—ride-hail and food delivery—it was neither the first nor the last time investor excitement around high-growth businesses exploiting the three characteristics described above (focus on scale, orchestration, and consumer value). Notably, but less well-known, the vast majority of users and revenues are concentrated in the same handful of large cities around the globe. As late as its 2019 IPO, nearly one-quarter of Uber's revenues, for instance, still came from just five metropolitan regions—New York, Los Angeles, San Francisco, London, and São Paulo.[7]

16. This was not the first time the connection between urban tech and big business was clearly made. As geographer Richard Shearmer wrote in 2016, "Urban technology is the new frontier, a space into which big business is entering: after defence, health care, telecommunications and utilities, the management of our cities is being altered by digital and bio-technologies."[8] And the New York City Economic Development Corporation 2019 urban tech strategy identified a number of subsectors for future commercial development: mobility + logistics; real estate + construction tech; gov tech + civic tech; IoT + connectivity; clean tech + smart energy; food, waste + water tech.[9]

17. For all the breathless talk of funding rounds, future profits, and job creation, the urban tech sector is shot through with broader purpose. Almost all urban tech companies start out with a stated goal or desire to improve the lives of people in cities, while also producing financial returns. As Charles LaCalle, a venture capitalist puts it, "Most urban tech startups have a double bottom line — enabling venture investors to get top-tier returns while improving the lives of people in cities, large or small. Investors can increasingly achieve long-term financial success and affect positive social, environmental and economic change for local communities."[10] Some

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[6] Richard Florida, *The Rise of Urban Tech: A Preliminary Assessment,* October 2018, http://www.creativeclass.com/_wp/wp-content/uploads/2019/11/The-Rise-of-Urban-Techv2.pdf
[7] Henry Grabar, "Uber Revales One of Its Big Vulnerabilities," *Slate,* April 12, 2019, https://slate.com/business/2019/04/uber-ipo-nyc-london-risks.html
[8] Richard Shearmur, "Debating Urban Technology: Technophiles, Luddites, and Citizens," *Urban Geography* 37, no.6, DOI: 10.1080/02723638.2016.1207914
[9] NYCEDC, *Urbantech NYC Digital Brochure 2019.*
[10] Charles LaCalle, "What is urban tech?" *Quora,* June 20, 2017, https://www.quora.com/What-is-urban-tech?share=1

preserve these goals, principles, and values. But for many these aspirations often become muddled, conflicted, or corrupted along the way. Thinking of the sector broadly as a "social-ish" enterprise helps capture these sometimes complementary, sometimes conflicting, and not infrequently corrupting dynamics.

18. **Urban tech is made by many players working together.** Even more so than traditional urban systems engineering, the full life cycle of development, deployment, operation, and dismantling of urban tech involves vast networks of stakeholders working together. To get a sense of just how big and diverse these stakeholder networks can get, the map of relevant entities assembled for the Smart London planning effort in 2013 by Arup, a consultancy, includes hundreds of organizations in every sector of industry, government and civil society. (Figure 3) This stakeholder diversity is driven by the challenges of urban scale and urban complexity. It is simply difficult for any single firm or agency to achieve results without working with others. But the public interest in the workings and outcomes produced by urban tech also drives the expansion of stakeholder networks. As design scholar Laura Forlano notes, urban tech is deeply embedded in society's pre-existing values and politics. "Urban technology can be categorized across various levels from urban screens and surfaces… to networked objects and artifacts (smart traffic lights, trash cans, sensor-enabled street lights, surveillance cameras)… to technologies of the body (mobile phones, tracking devices, biometric feedback devices). Each of these levels is interconnected to form complex sociotechnical urban ecosystems that are embedded with nuanced values and politics."[11]

19. In recognition of these truths, considerable effort has gone into creating protocols that move away from the closed corporate and military-industrial models of applied technology research in the past, and create models that are more transparent, participatory, and accountable to these urban stakeholder networks. For instance, the rich policy discourse on "living laboratory" models, developed primarily in the EU from about 2000 onwards as part of the "fifth framework" established multi-stakeholder models for urban technology innovation ecosystems, "defined as the collection of stakeholders, assets, and their interactions in city environments resulting in technology (in particular ICT)-based innovation and entrepreneurship."[12,13] Establishing the key role for universities to provide the basic research outputs that would stimulate applied innovations in *urban tech* (or, at the time, *smart cities*), policymakers created a set of playbooks to guide universities, corporations, municipalities and community stakeholders in collaborative efforts.

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[11] Laura Forlano and Anijo Mathew, *Designing Policy Toolkit,* Institute of Design at Illinois Institute of Technology, June 11, 2013, https://designingpolicytoolkit.files.wordpress.com/2013/07/designing-policy-toolkit-final.pdf

[12] Seppo Leminen , Veli-Pekka Niitamo , Mika Westerlund, "A Brief History of Living Labs: From Scattered Initiatives to Global Movement" in *OpenLivingLabs Days Conference Proceedings 2017*, p.48. [https://biblio.ugent.be/publication/8534167/file/8534169.pdf]

[13] Victor Mulas, Michael Minges, and Hallie Applebaum, *Boosting Tech Innovation Ecosystems in Cities : A Framework for Growth and Sustainability of Urban Tech Innovation Ecosystems,* Washington, D.C: World Bank, https://openknowledge.worldbank.org/handle/10986/23029.

Aims

20. At the launch of its Urban Tech Hub, Cornell Tech adopted one of the more succinct and sweeping definitions of urban tech, which states simply: "Urban tech is a nascent sector of innovation that encompasses products that make cities and urban spaces more connected, livable, and efficient."[14] This definition highlights important elements of the field's ambitions—to provide novel capabilities that expand the reach and flexibility of urban systems ("connected"), to put these capabilities to use in ways that improve quality of life for city dwellers ("livable"), and do so through the application of stringent engineering performance standards ("efficient"). This definition, while succinct, left a number of gaps in its brevity, notably:

    a. Failure to articulate a vision for developing a unique branch of knowledge dealing with the engineering of technologies for building, operating, and dismantling urban systems;

    b. Omission of a clear statement about aligning with government's policy objectives and regulatory authority;

    c. Lack of explicit recognition of the multiple roles that city dwellers play in the creation, deployment, and ongoing operation of urban tech—participants, co-creators, users and perhaps more.

    This definition, however, also highlights the difference between *definitions* and *aims—what* the field is or does, and what it aspires to achieve or influence.

21. So far, I have summarized what I see as a consensus set of definitional elements of what urban tech *is*. In this brief section, I take a more speculative voice, and argue that these definitions and other ongoing developments point towards an emerging set of ideas about what urban tech *ought to be*. Aims are a purpose or intention, or a desired outcome. This is different from a definition because it speaks to the why, rather than the what or how of the field.

22. There are any number of useful starting points to draw on from the last decade of thinking about smart cities. For instance, Open Canada identifies the following principles for smart cities: resilient and adaptive, inclusive, participatory, open by default, tech-driven, accountable and transparent, user-centered, and resource optimized.[15] Many these resonate with what we find across the urban tech domain, but not all. Additionally, several others are present. The most salient follow below.

23. **Measurable.** If nothing else, urban tech aims to quantify all aspects of its operation and impact. This particularly extends to its measurable improvement in human well-being. The ultimate customer for urban tech is, above all, the city dweller—not the city government, though government often plays an enabling or intermediary role. Verifiable information about the results of urban tech interventions is key to making the case.

24. **Universal.** Despite emerging out of, and leveraging the programmable network technology of the digital age, urban tech's scale is not selective. It reaches everyone without redlining. It is about

[14] Charles LaCalle, "What is urban tech?"
[15] Future Cities Canada, *Getting to the Open Smart City,* Discussion Paper October 2018, https://futurecitiescanada.ca/downloads/2018/Getting_to_Open_Smart_City.pdf

turning on, not turning off. Even though it can deliver personalized results, urban tech is also built to work across entire cities, work over long periods of time, and do so in ways that were impossible or unthinkable before (without public subsidy for instance).

25. **Public.** Urban tech focuses on the shared space of the city, and the communally-governed resources that lie within. It aims to create technology that informs, empowers, orchestrates, and cares for people and the built environments they inhabit. In doing so urban tech creates, expands, and protects extraordinary new sources of public value.

26. **Legible**. Data and technology are alienating and excluding a large part of the population. Visualizations and simple tools for accessing and understanding data—including the collection and use of data about and within public space (see for instance Sidewalk Labs' "Digital Transparency in the Public Realm" project[16])—allow lay people, not just professionals to engage with the raw material of urban tech.

27. **Gentle.** Urban tech practitioners want to "move fast" as the Silicon Valley cliché goes, but they generally don't want to "break things" that they can't fix. Urban tech borrows from Silicon Valley's culture of fast prototyping, but it aims to be much more sensitive about recognizing and mitigating the dissonance and damage that this way of working can cause in non-insider communities and institutions. Reform, not disruption, is the codeword here. This applies equally to silos in government or academic disciplines.

28. **Governed.** The smart cities movement sought to enlist the private sector in new, vital, and often radically expanded new city-building and city-governing roles. It overstepped time and time again. Urban tech moves the private sector back to a more subordinate, but redefined, role. It seeks to create capabilities to improve government itself; improve the ability for citizens, NGOs. and government to co-produce services; and improving the ability for markets to create triple-bottom line value that is aligned with city policy goals. Urban tech is welcoming of oversight as a way of creating fair, competitive, and stable markets.

29. **Generative.** Urban tech creates shared capacity to adapt to future challenges. It generates—either as a primary output, or byproduct—tools, components, services, and data that can support future problem-solving and innovation. This includes open data repositories, standards, protocols, architectures, reference designs, and other schematics that encourage collaborative research and development.

[16] Jacqueline Lu, "How can we bring transparency to urban tech? These icons are a first step." *Medium (blog),* April 19, 2019, https://medium.com/sidewalk-talk/how-can-we-make-urban-tech-transparent-these-icons-are-a-first-step-f03f237f8ff0

Ethical Tensions

30. Ethics are standards of behavior that we use to judge right and wrong. They are different from aims because they provide an unvarying, externally-fixed point of reference about the fairness and harmfulness of a field's intentions and aspirations. For instance, which biotechnologists have long sought the ability to directly manipulate genomes programmatically, the development of CRISPR-Cas9 technology, which makes it possible to alter human germline cells and embryos has crystallized ethical issues about the application of this knowledge. These include the accidental introduction of "undesirable changes in the genome, from whom and how informed consent is obtained, and the breeding of the human species (eugenics)."[17]

31. In computer science and information technology, a fast-growing network of ethical debates now engage with a variety of inter-related consequences arising from the widespread application of sensors that collect personally-identifiable information, machine learning and other artificial intelligence techniques that use it to create predictive models, and the business processes in which these predictive capabilities are deployed in markets and civic life. These debates are drawing attention to how invasive sensing, big data, abundant computation, and predictive models are reinforcing existing forms of bias, both implicitly and explicitly; enabling new mechanisms of discrimination to be created that are not well regulated under current statutes and norms; all of which are difficult to detect and difficult to classify.

32. These broader ethical tensions are reviewed extensively elsewhere, and won't be discussed in depth here.[18] I note them for one reason—they foreshadow a set of concerns that are even more problematic in urban tech. That's because urban tech deliberately transgresses many of the self-imposed limits that companies like Google, Facebook, etc. frequently overstep, but often try to re-establish. Consider, for example the present efforts to find a workable solution for regulating disinformation and political speech on social media. In contrast, urban tech is often working to influence power structures *by design*, often in rather undemocratic ways. Urban tech is also primarily spatial in orientation and intent—it emphasises acting and reacting to the physical world of people, structures, and vehicles. This has profound consequences on the distribution of resources, improving efficiency at the expense of increased inequality and exclusion. Indeed, these lessons aren't new. They've been well-learned through over a half century's experience employing computation in urban planning and management. Urban tech proposes to repeat many of these past oversights and omissions, scale them up as rapidly as possible, and embed them more thoroughly in the city.

33. This analysis is meant as a checkpoint. In the following paragraphs, I lay out a set of ethical tensions that draws on both contemporary debates about technology and society, lessons learned through the failures of smart city policy frameworks and industry campaigns over the last decade, and my own observations on recent developments in urban tech. It is a starting point for discussion about which of these tensions dig deeper than differing perspectives on policy, but

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[17] Fatma Betül AYANOĞLU,1 Ayşe Eser ELÇİN,1 and Yaşar Murat ELÇİN, "Bioethical issues in genome editing by CRISPR-Cas9 technology," *Turkish Journal of Biology 44 (2): 110-120,* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7129066/.

[18] danah boyd and Kate Crawford, "Critical Questions for Big Data: Provocations for a cultural, technological, and scholarly phenomenon," *Information, Communication & Society 15(5): 662-79,* https://www.tandfonline.com/doi/full/10.1080/1369118X.2012.678878

rather need to be addressed at a more fundamental ethical level in engineering education, research, and practice.

34. **Legitimacy versus expedience.** The first tension arises before urban tech engineers ever enter the picture. How do we establish legitimacy as participants in a problem-setting or problem solving process? From whom do we seek permission, and how? Failure to obtain this legitimacy can derail even the most well-resourced urban tech enterprise, as was demonstrated repeatedly in the last few years—in Berlin's rejection of the Google Umspannwerk complex, Amazon HQ2 in New York City, and Sidewalk Toronto's Quayside project. In each case, city governments and a technology corporation conceived and presented a large technology-enabled urban real estate plan to the public that was significantly far along to create the perception that permission had been granted. When new stakeholders with dissenting views identified themselves and built effective political alliances to challenge the process, these claims were quickly delegitimized. As Bianca Wylie, a key organizer in the effort against Sidewalk Toronto has noted, while many of the arguments against that project dealt with its urban tech agenda, the original had little to do with its technology proposal but rather a series of bad faith moves to subvert well-established governance processes in the name of expedience.[19]

35. This tension comes first because it continues to grow. Cities face a growing array of challenges with dwindling resources and a clock that is fast running out. Urban tech is likely to be seen as an expedient path through the coming austerity. But will it deliver? Or will boosters oversell its cost-cutting potential and understate the side effects? Both cities and their private sector partners need to become more effective at obtaining permission to employ relevant and appropriate technological interventions, while also becoming sharper at identifying and mitigating the risks. In the past, smart cities projects have failed to win support because they often don't address the problems people care about. But there are times when a new technology-enabled solution is developed that can benefit many people. When do circumstances merit urban tech practitioners' soliciting legitimacy and permission to intervene? A process for sharing this information needs to be in place.

36. **Equity versus efficiency.** Urban tech solutions deployed in the marketplace often "cherry pick" *by design*, excluding difficult individuals or groups because they are more costly or time-consuming to deal with. By deploying mechanisms like ratings, personalized pricing, and other predictive behavioral models they can explicitly encourage desirable uses or discourage undesirable uses more comprehensively and precisely than in the past. Meanwhile, the way these mechanisms are created may introduce additional implicit forms of bias and discrimination that are more difficult to detect, and potentially may breach existing rules and ethical norms.

37. Producing equitable outcomes in urban tech, however, may drive up the cost or slow down the pace of development. It may require rethinking business models to allow a service to operate profitably across a wider market, or managing investor expectations on returns. It certainly will require greater vigilance in scanning for, and mitigating, implicit biases in sensing and automated decision making systems. This isn't to say that equity and efficiency are inversely related in all circumstances. There are many ways that urban tech can create new synergies that achieve

[19] Bianca Wylie, "Sidewalk Toronto: Violating Democracy, Entrenching the Status Quo, Making Markets of the Commons," *Medium (blog),* April 20, 2019, https://medium.com/@biancawylie/sidewalk-toronto-violating-democracy-entrenching-the-status-quo-making-markets-of-the-commons-8a71404d4809

greater equity and greater efficiency. But the perception is there. In some cases it may be valid. And it must be addressed, with evidence.

38. **Opportunism versus oversight.** Urban tech companies have achieved global scale by entering large numbers of markets before regulators can respond effectively. Two things are key—deep pools of risk capital and easily replicable business models, both of which can be deployed anywhere in the world instantaneously. Meanwhile, they do not equip themselves to even understand the problems they may be causing in local markets. As Molly Turner, who established the public policy team AirBnB has noted, when she joined the company it was already operating in 19,000 cities and no one in the company understood what a hotel tax was.[20] What's more, this opportunism often piggybacks on the public weal. As Turner further notes, companies like AirBnb and Uber frequently fail to acknowledge that their businesses are built on top of public infrastructure.[21]

39. Resolving this ethical knot requires better behavior from companies. Leadership changes at companies like Uber helped put an end to some of the most unethical practices, such as the company's secret "Greyball" program which identified enforcement officials and spoofed their phones with "ghost cabs". But extensive and often questionably ethical campaigns to lobby for pre-emptive legislation at the state and provincial level continues unabated, and direct messaging campaigns to users through apps seeks to influence the outcome of democratic processes such as the imminent Proposition 22 in California, Uber-backed ballot measure that would classify ride-hail drivers as independent contractors.

40. Progress will also require effective responses from regulators, including the creation of better-regulated markets for urban tech players. In 2013, for instance, Taiwan undertook a crowdsourced online process of consensus-based rulemaking to establish firm but clear rules for ride-hail aimed at maintaining safety and competition. In the years since, it has repeatedly used these regulations to restrict ride-hail giants like Uber from anti-competitive practices, and the broad engagement by which the rules were made has helped to legitimize the regulatory structure and the ride-hail sector more broadly.[22]

41. **Public good versus private harm.** Urban planning, design, and architecture all fundamentally deal with the art and science of balancing public and private interests. The introduction of powerful technologies that rapidly and profoundly alter the traditional relationship between public and private has been destabilizing. It's fair to say that the response has been late, inadequate, and incomplete.

42. A case in point is the way in which Sidewalk Toronto approached the issue of data privacy in the rollout of its development proposal for the Quayside district in 2017. Upon official announcement of the company's selection to move forward in October of that year, Sidewalk Labs and Waterfront Toronto released a collection of documents which included hundreds of pages of text, charts and illustrations dealing with physical components of the proposed district. The depth of research and

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[20] "The Future of Urban Tech: Richard Florida, Anthony Townsend, and Molly Turner," *Bloomberg CityLab,* October 29, 2019, https://web.facebook.com/236061986423933/videos/505601976950293/
[21] *Ibid.*
[22] Martin King, "Building Consensus and Compromis on Uber in Taiwan," *Center for Public Impact,* September 18, 2019, https://www.centreforpublicimpact.org/case-study/building-consensus-compromise-uber-taiwan/

production quality all clearly reflected months, even years, of preparation. The sole statement on data privacy, however, took the form of a separate two-page memorandum.[23] It was telling of the conflicts to come that Sidewalk Toronto's underground system for automated waste removal had received more substantial treatment than its mechanisms for storing and securing its inhabitants' private data.

43. There are many efforts underway around the world to wrestle with this dilemma. They all struggle with a number of questions. When and how should cities share data they collect with third parties to advance policy goals? How do we ensure the public is fairly compensated for private use of public assets? When and how should companies be compelled or incentivized to share data with city governments for regulatory compliance or other public purposes? How do we assess the risks of data sharing and data aggregation? Who do these these data flows and repositories empower, and who do they disempower? Who is likely to misuse this data, and how do we stop them? Sidewalk Toronto showed us the importance of tackling these questions at the outset of any large urban tech-intensive enterprise, before significant other planning has taken place, and (as others have documented extensively elsewhere[24]; see also "Legitimacy versus Expediency" above) the need for this process to be initiated by someone other than the private sector.

[23] "Documents," *Sidewalk Toronto,* accessed October 28, 2020, https://www.sidewalktoronto.ca/documents/

[24] Bianca Wylie, *Medium (*blog), accessed October 28, 2020, https://medium.com/@biancawylie.

Next Steps

44. Where do we go from here? At least two directions present themselves for further exploration and experimentation.

45. First; what does "good" mean in urban tech, and how do we go about defining it? Trenham and Steer's "Good Data Manifesto" [2019] offers an interesting case study in how a simple set of ethical guidelines covering a ubiquitous layer of the urban tech stack—in this case regarding data collection, storage, and re-use of data—can raise the standard of practice.[25] In their view, data must be useable, or fit for purpose; collected for this purpose, not incidentally; published; revisable; and valuable to society. By creating this litmus test for "good data", they create a standard to which any data-involved effort can assess itself ethically. How can frameworks such as these be extended to more specific problems in the domain of urban tech? Rewinding a step, how do we design participatory planning or research processes to ensure that these efforts have legitimacy and reflect a fully-representative set of values? In the tradition of advocacy planning, for instance, who identifies and speaks for stakeholders who are not empowered to protect their own interests in these processes?

46. Second; which, if any, of these ethical dilemmas are moving fast and far enough ahead of policy and regulation that students and practitioners need to be equipped to deal with them in the absence of clear guidelines? No doubt, the blurry line between what I have called 'ethics' in this essay and what would traditionally be called 'policy' sits uncomfortably. This is my intent, because urban tech is a field where issues will arise—in research, practice, and education—where policy and norms have not caught up with the new challenges raised by technology. When confronted with a client request to push ahead on an algorithm that has demonstrated a clear implicit bias which, while not technically illegal and unlikely to be discovered, does raise an ethical red flag—what are the engineers' responsibilities? On what principles does she evaluate her possible courses of action? To what code of conduct does she adhere? What processes and institutions are at her disposal to protect whistleblowers, preserve evidence, and hear and adjudicate professional conduct disputes? Were she designing a structural member, and asked to reduce the margin of safety to cut costs, her response would be clear. We should aspire to this level of clarity as the field's tools, techniques, and aspirations continue to become more clear.

47. This will not be easy. When a client or supervisor requests changes to a recidivism risk scoring algorithm that is used to set sentencing guidelines, what are an engineers' ethical obligations to understand the downstream impacts on judges' ultimate decisions as they set out to do their feature engineering? We don't want engineers to be given permission to make policy. But we certainly don't want them or their clients to do it without us knowing either. This is all about establishing guardrails.

48. In closing, we should recognize urban tech's opportunity to lead the movement for more ethical technology. Urban tech has enormous contributions to make in improving our ability to build and operate cities that are more efficient and more livable—but it will not do so unless it overcomes

[25] Claire Trenham and Adam Steer,"The Good Data Manifesto" in *Good Data*, eds. Angela Daly, S. Kate Devitt, and Monique Mann (Amsterdam: Institute of Network Cultures), ISBN 978-94-92302-27-4. https://networkcultures.org/wp-content/uploads/2019/01/Good_Data.pdf

the significant ethical tensions that are inherent in that aspiration, which I have started to describe here. However, urban tech is not alone in this ethical ceiling.

49. Computer science itself is only just beginning a much-needed self-examination that seeks to dismantle the racism, sexism, and classism that's defined it since the start. This critique is harsh, yet long-overdue. As a recent pre-press article by Abeba Birhane and Olivia Guest argues, "[t]he healthy progression of computational sciences is one that necessarily examines, learns from, and dismantles its historical and current racist, colonialist, and oppressive roots, albeit through a gradual process. Such a journey is beneficial not only to Black women but also to science in general."[26] It is also urgent. The field has been sliding backwards, at least with respect to gender. As journalist Clive Thompson concluded after a multi-year investigation, "[t]he result is an industry that is drastically more male than it was decades ago, and far more so than the workplace at large."[27]

50. What makes urban tech different are its roots. When I explain urban planning theory to prospective students, I often facetiously summarize it as "a history of failures". I'm only half-kidding. Urban planning has decades of experience with gut-wrenching internal and external struggles over ethics. It has reinvented itself many times to deal with these ethical crises, and developed a powerful, if still inadequate, set of theoretical and practical tools for navigating them. All of this is to say, the opportunity for urban tech may be to guide the way for -tech more broadly on its journey into the ethical unknown.

Figure 1. Google Ngram results for -tech terms: cleantech, edtech, medtech, 2000-2019 (author, September 2020)

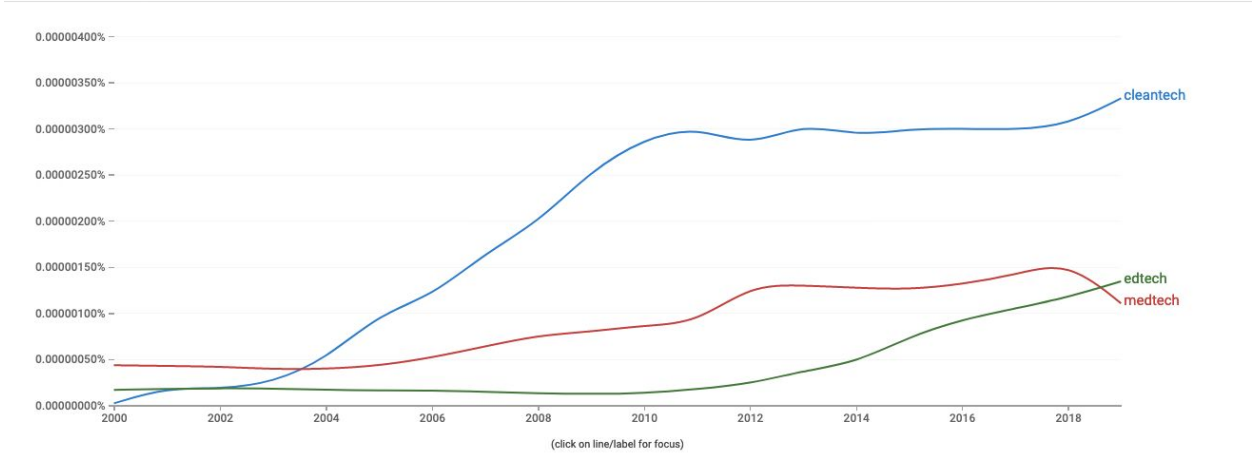
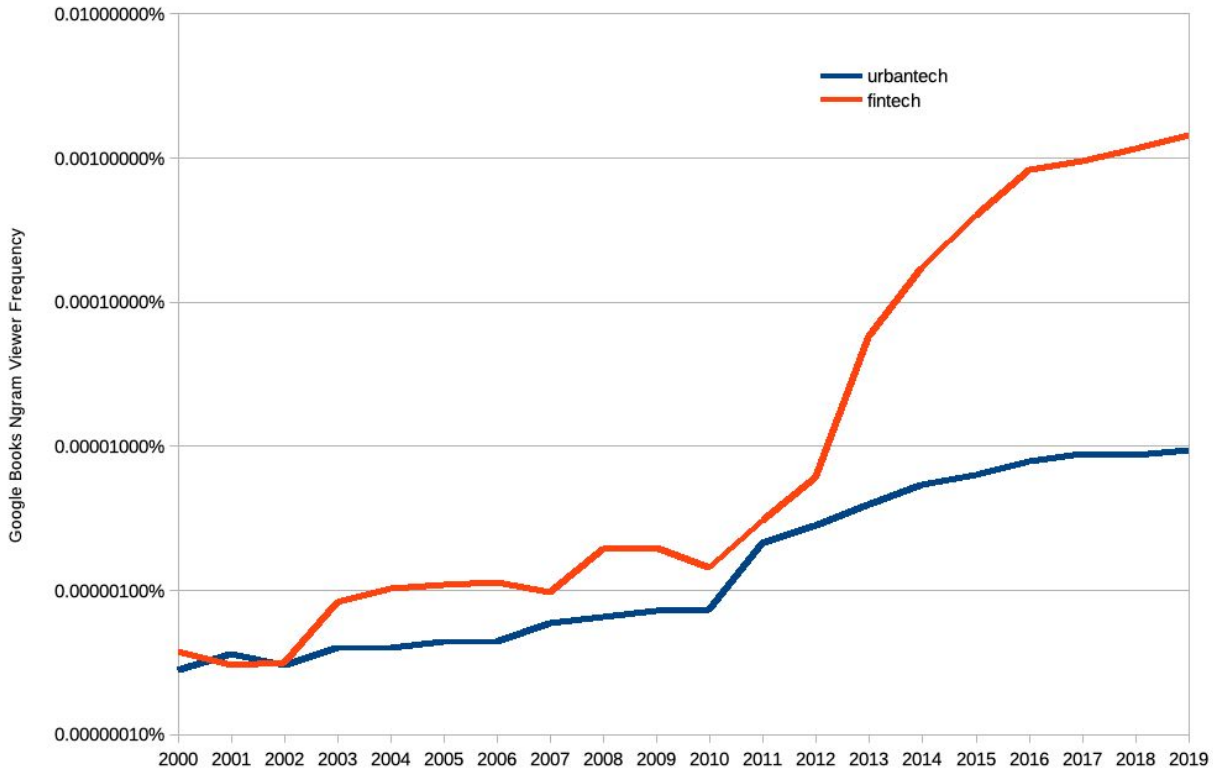


Figure 2. 'Urbantech' and 'fintech' enter the lexicon (logarithmic scale)

[26] Abeba Birhane and Olivia Guest, "Towards decolonising computational sciences," *arXiv,* https://arxiv.org/abs/2009.14258

[27] Clive Thompson, "The Secret History of Women in Coding," *New York Times,* February 13, 2019, https://www.nytimes.com/2019/02/13/magazine/women-coding-computer-programming.html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0.00000100%
0.00000010%
Google Books Ngram Viewer Frequency
urbantech
fintech
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

Figure 3. Smart London stakeholder map (Arup, 2013)