Programming Place:

The Question of the Smart City

Alex Scott
Graduate Project
2018 - 2019
Joe Dahmen

Release Form

Landscape Architecture
School of Architecture and Landscape Architecture
University of British Columbia

Name: Alexandra Scott

Student Number:

Graduate Project Title: Programming Place: The Question of the Smart City

Alexandra Scott		April 26, 2019
Name	Signature	Date

Abstract

The Internet of Things and the lure of smart cities are poised to revolutionize the urban areas of North America. Digital technology has introduced ubiquitous communication and influenced the organization of urban areas, and together this has changed the ways in which people use urban public spaces. Now, the possibilities of the integration of digital technology into the physical infrastructure of the city has technology companies eager to partner with municipalities to realize the economic and managerial benefits of big data. The realities of the implementation of the smart city concept, however, has raised myriad concern around the role of private interests in public life with regards to privacy, ownership, control, and inequality. Many of these concerns play out in public spaces, as they are integral to the enactment of public life in cities while also increasingly funded, and therefore influenced, by private interests. What, then, are future programmatic and technological possibilities for urban public space that seize the opportunities while addressing the concerns?

This project proposal first seeks to understand the historical and contemporary roles and functions of urban public space and real estate development, as well as big data. Then, it explores the influence of technology on the human understanding and organization of space to unpack the influence of the Internet of Things. Finally, a design project is proposed for the public space in Sidewalk Toronto's Quayside development that seeks to address these phenomena through the thinking of the philosopher Hannah Arendt.

Table of Contents

i Abstract

iv List of Figures

Part I: The Development of Digital Space

1 Introduction

3 Context
- 3 Roles of Urban Public Space
- 7 Real Estate Development and Urban Revitalization
- 11 Big Data

13 Technology and Space
- 13 Mapping
- 14 Systems Thinking
- 15 The Organization of Space
- 16 Internet of Things

21 Development of Digital Space
- 23 Implications
- 24 Conclusion

27 Design Proposal
- 28 Site
- 33 Plan of Work

Part II: Programming Place

37 Design

68 Works Cited

List of Figures

Figure 1. (1870). *Stereographic Image of Outdoor Life and Sport in Central Park*, [stereograph]. NYPL Digital Collections. Retrieved from https://digitalcollections.nypl.org/items/510d47e1-ae3c-a3d9-e040-e00a18064a99

Figure 2. Yourdon, Ed. (2009). *Man in Bryant Park*, [photograph]. Flickr Commons. Retrieved from https://flic.kr/p/6i3q8n

Figure 3. Author. *Big Data*, [image].

Figure 4. Nolli, Giambattista. (1748). *Nuova Pianta di Roma*, [image]. Wikimedia Commons. Retrieved from https://commons.wikimedia.org/wiki/File:Giovanni_Battista_Nolli-Nuova_Pianta_di_Roma_(1748)_05-12.JPG

Figure 5. Snow, John. (1854). *Cholera Map*, [image]. Wikimedia Commons. Retrieved from https://commons.wikimedia.org/wiki/File:Snow-cholera-map-1.jpg

Figure 6. Author. *Cybernetic Control and Communication*, [image].

Figure 7. Author. *The Internet of Things*, [image].

Figure 8. Echlin, John. (2011). *Masdar, UAE*, [photograph]. Flickr Commons. Retrieved from https://flic.kr/p/rxLHJS.

Figure 9. (2015). *Songdo, South Korea*, [photograph]. Flickr Commons. Retrieved from https://flic.kr/p/rxLHJS.

Figure 10. Author. *The Development of Digital Space*, [image].

Figure 11. Author. *Site Map*, [image].

Figure 12. *Eastern Portion of Quayside Site*, [photograph]. Google Maps.

Figure 13. Unknown - American Memory. (1975). *Hannah Arendt,* [photograph]. Wikimedia Commons. Retrieved from https://commons.wikimedia.org/wiki/File:Hannah_Arendt_1975_(cropped).jpg

Figure 14. Author. *The Public Realm,* [image].

Figure 15. Author. *Public Identity,* [image].

Figure 16. Author. *Program Analysis,* [image].

Figure 17. Author. *Design in Context*, [image].

Figure 18. Author. *Design Plan*, [image].

Figure 19. Author. *Program Diagram*, [image].

Figure 20. Author. *Sensor Plan*, [image].

Figure 21. Author. *Sensor Organization*, [image].

Figure 22. Author. *Plaza Perspective*, [image].

Figure 23. Author. *Plaza Section*, [image].

Figure 24. Author. *Plaza Plan*, [image].

Figure 25. Author. *Play Area Perspective*, [image].

Figure 26. Author. *Play Area Winter*, [image].

Figure 27. Author. *Play Area Plan*, [image].

Figure 28. Author. *Play Area Section*, [image].

Figure 29. Author. *Community Garden Perspective*, [image].

Figure 30. Author. *Garden Section*, [image].

Figure 31. Author. *Garden Plan*, [image].

Figure 32. Author. *Pool Perspective*, [image].

Figure 33. Author. *Hot Tub Perspective*, [image].

Figure 34. Author. *Dock Perspective*, [image].

Figure 35. Author. *Pool Plan*, [image].

Figure 36. Author. *N-S Section*, [image].

Figure 36. Author. *E-W Section*, [image].

Acknowledgments

Throughout the process of working on this graduate project I have received much support and assistance. First I would like to thank my supervisor, Joe Dahmen, for his help in giving this research direction and providing multitudes of design advice. As well, project course instructors Daniel Roehr and Susan Herrington for their encouragement and guidance.

I would also like the acknowledge my fellow classmates and friends for their unwavering support in tough times, feedback throughout the stages of this project, and help with final drawings. Thank you for everything.

The Development of Digital Space

Introduction

Urban public spaces reflect the socioeconomic concerns and realities of their times. As places, they serve vital recreational, democratic, and consumptive roles for the public and as constructed spaces they meet the needs and objectives of municipal governments and private developers. In the 21st century, changes in society, business, and governance driven by digital technology are reshaping public spaces. Here, digital technology refers to physical devices and software systems that encode data in bits: computers, smartphones, cameras, sensors, satellite navigation systems, the Internet (Kitchin, 2014). Digital technology has revolutionized communication networks, allowing for a proliferation of instant methods of connection (ibid). As the communication network of public life, urban public spaces are entangled with digital technology (Castells, 2004).

Recently, technology companies seeking to partner with municipalities to build smarter cities using data and responsive technologies have raised both hopes and concerns for the future of the city. These companies range from computer monoliths like IBM and Intel to Internet giants like Google and Amazon. Smart cities will run on computer software and hardware, generating terabytes of data that hold a potential wealth of economic value. Municipalities hope that this data will allow for efficient management of city services and infrastructure, and increased engagement with planning and government by citizens (Arup & RIBA). Citizens are concerned, however, that the data will be owned and controlled by private entities for profit, extracting value from cities without giving back to urban society (Balsilie, 2018; Fussell, 2018). As well, concerns about privacy and surveillance in public and private spaces abound (Galang, 2018).

These new relationships have led to speculation on digital technology as a new form of development and how people will interact with infrastructure in the smart city (Bliss, 2018). The merging of digital technology and real estate development introduces a new method of value extraction from the land predicated on data from human behaviour and urban systems. The centralization of digital technology within the city can also be understood as a neoliberal marketing strategy to attract and grow creative and knowledge-based industries and engage their workers, potentially at the expense of other segments of society (Hollands, 2008; Shelton et al., 2015). Digital development is a practice that will have fundamental impacts on urban society and the roles and functions of urban public space, generating questions about their programmatic and technological possibilities.

Context

To begin to address the question at hand, it is first necessary to discuss the historic and contemporary roles of public space in urban life, the way real estate development is conducted, and how the phenomenon of big data alters these relationships.

Roles of Urban Public Space

Public space is central to the process of urban development; it is part of the infrastructure that makes the city possible (Waldheim, 2006). In North America, urban public spaces generally serve one or more of the following purposes: as spaces of recreation and leisure, as civic spaces, and as spaces of consumption. By examining the origin and execution of these ideas, one can begin to understand how technological systems are mutating these roles.

Spaces of Recreation

Somewhat paradoxically, the development of spaces specifically for public recreation began with cemeteries. In North America in the 1830s, large, pastoral cemeteries were built outside of the city in response to concerns over overcrowding and public health with urban cemeteries. Urban populations began to flock to these place, such as Mt. Auburn Cemetery outside of Boston, to spend leisure time outdoors, as there were not open public spaces in the city where they could do so. In response to this trend, and continued concerns over public health, large public parks were developed in cities to accommodate the recreational needs of urban populations (Giguere, 2018).

Perhaps the most famous of these parks is Central Park in New York City, designed by Fredrick Law Olmsted and Calvert Vaux. Olmsted believed the value of public parks to be in the provision of “a long, unbroken, spacious drive, ride and walk, offering suitable conditions to a large number of people to obtain together moderate exercise in the open air, with such other conditions favorable to gaiety” (1881, p. 17). He firmly believed in the necessity of recreational spaces in cities, for reasons of both public health and community building (Meyer, 2007). Olmsted was influenced, of course, by the famous parks of Western Europe, Hyde Park in London, the Bois de Boulogne in Paris, and others in Florence, Munich, Berlin, and Stockholm, many of which were converted from royal property to public spaces (1881).

The social mores of the 19th century dictated passive recreation patterns, like those Olmsted described, that are different from those of the 21st century.

Fig 1. Stereographic Image of Outdoor Life and Sport in Central Park
From the New York Public Library

Approximately 66% of North Americans now own smartphones, changing how they communicate, socialize, and use public spaces (Rainie & Zickuhr, 2015). Smartphones blur the distinction between public and private spaces. Their use in urban public space is replacing public social activities (Hatuka & Toch, 2016). Smartphones offer myriad entertainment options, like watching videos, listening to music, and playing games, that can replace traditional face-to-face communication and passive recreation. 18% of cellphone users in a survey reported frequently using their phones in public just for something to do, while 32% of users reported occasionally doing so (Rainie & Zickuhr, 2015). This trend is not wholly negative, however, as an even larger percentage of cellphone users utilize their devices in public to arrange to meet up with friends or catch up with others who aren't present (ibid). The usage of smartphones alters and extends the perceptual boundaries of social space beyond urban public spaces, as well as altering the social norms we enact in those spaces, redefining spaces of recreation (Hatuka & Toch, 2016).

Spaces of Democracy

The link between public space and democracy in the Western world has been clear since the beginnings of democratic society, in ancient Athens. The heart of the city was the agora; an open, unpaved public space that combined political, administrative, economic, and social functions side by side (Gottesman, 2014). Here, citizens gathered to do business and participate in civic life. The Roman forum was a similar type of public space that was central to many cities in the Roman Empire (Laurence et al., 2011). The forum would have had buildings for trade and government, but it was necessary that the government buildings be designed such that the discussions inside were audible to those assembled in the plaza outside, clearly emphasizing the importance of public space in Roman political life (ibid). The ability for citizens to freely meet, discuss, and engage with political matters in public space was crucial for democracy (Gottesman, 2014).

Olmsted also believed that gathering in a public space fostered democratic community and a sense of citizenship (Meyer, 2007). Hyde Park, one of Olmsted's inspirations, has had a legislated Speaker's Corner since 1872, where anyone can come to speak freely on any lawful topic at any time ("Speaker's Corner"). Public spaces have also served as spaces of political demonstration, as with suffragettes meeting in Hyde Park, Martin Luther King, Jr.'s delivering his 'I Have a Dream' speech at the Lincoln Memorial, Washington, D.C., and the Idle No More round dance flash mobs in malls across Canada. Public spaces are "stages on which various publics come together in all their contentious differences, sparking a conflagration of public, political, and social interaction" (Beardsley, 2007, p. 202). In a society that seems increasingly unequal and divided, it is crucial to democratic life to have accessible spaces where people may be exposed to different lifestyles and points of view.

Now, the Internet is also connecting disparate members of society. Scholars are unclear, however, on the overall effects of online discussion and social media sites on users' politics (Brundidge & Rice, 2010). While people log on to the Internet to seek out like minded people, evidenced by the homogeneity of political discussion groups online, the Internet also breaks down traditional

geographic and socio-economic barriers that crystallize political views (Brundidge & Rice, 2010; Wojcieszak & Mutz, 2009). Much of the political information shared on the Internet is about people acting and events occurring in space, such as videos of protests and photos of crisis situations (Parkinson, 2012). Communication through social media makes organizing these very protests easier (ibid). The Internet and social media have become important forums for political discussion, augmenting the role of urban public spaces in democracy as ubiquitous usage of smartphones blurs the divide between personal and private, and online and offline. The role of urban public spaces in democratic expression has been reaffirmed, although redefined, by digital technology.

Spaces of Consumption

The example of the Greek agora and the Roman forum also demonstrate that public spaces have supported commerce and consumption since the Ancient world. These were spaces that offered a wide range of wares for sale, first in temporary stalls and later in permanent buildings (Gottesman, 2014). The temporary market continues to be a wildly popular program in public space. David Harvey classifies public space, including parks, sidewalks, and plazas, as part of the "consumption fund". This type of space serves as "an instrument of consumption" (Harvey, 1982, p. 229). They are the infrastructure that supports the urban public in buying and selling goods and services. He acknowledges that some public spaces, such as roadways, may be used for both production and consumption (ibid).

The revolution of digital technology regarding consumption and public space is its elevation of the 'prosumer' and its liberation of traditional methods of working. Prosumers are both producers and consumers; they participate in the production of the goods and services they consume (Ritzer & Jurgenson, 2010). While people have always been 'prosumers' to an extent, the Internet relies on prosumption and user-generated content (ibid). Social media websites like Facebook and web retailers like Amazon rely on prosumers to generate posts and the goods for sale, respectively. Profit is often generated from selling information, advertising, or from leveraging the popularity of the website's brand (ibid). There is debate in the literature over whether prosumers are more or less easily exploited by corporations, which rests on whether they are controlled as temporary unpaid employees or empowered to act as they wish (ibid). In aggregate, however, Ritzer & Jurgenson suggest that prosumption heralds a new form of capitalism driven by abundance and effectiveness, rather than scarcity and efficiency (ibid).

As well, the combination of personal computers and communications technology has liberated people from their desks and allowed for work activities to take place in public spaces, bringing production into public space. The gig economy, composed of non-traditional freelance work, has also helped dissolve the boundaries of work spaces (Semuels, 2018). The Internet has greatly facilitated this work with websites like Fiverr, TaskRabbit, and Upwork, online platforms through which freelancers can sell their services (ibid). People can send emails from bus stops and edit reports from park benches. At the same time, they may also be prosuming by posting to social media and clicking on links that generate ad revenue. Clearly, the nature of consumption in public space is changing and expanding as consumption and production merge and work becomes mobile, further encouraging the collapse of public and private space engendered by smartphone use.

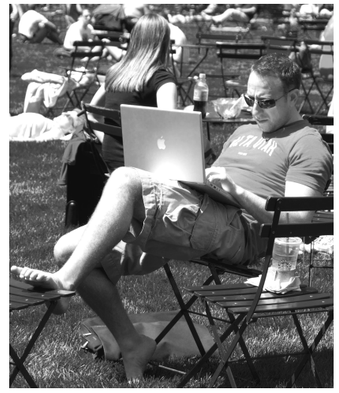


Fig 2. Man in Bryant Park
Ed Yourdon, 2009

Real Estate Development and Urban Revitalization

As the real estate development profession grew through the 20th century in North America, it gained power in shaping the urban built environment. In her recent book on the topic, Sara Stevens notes that "real estate development changes the physical and social geography of cities" (2016, p. 245). There is an overarching assumption that the interests of private landowners drive urban development, with real estate developers being among the most monied and influential of landowners (Eidelman, 2016). Scholars have theorized that the role of rest of the city's land, the publicly-owned built environment, is to support the process of capitalist accumulation for private landowners (ibid). Urban public spaces may be on publicly-owned land, or they may be privately-owned and developed as part of a larger real estate development. On privately-owned land, public spaces are entangled with real estate development in one of two ways: as supporting context, often as a tool to raise the value of surrounding properties, or as a result of the development process (Larson, 2018). As the development profession responded to changing social mores over the 20th century, its influence on the built environment evolved (Stevens, 2016). Consequently, a brief history of real estate development in North America will be discussed to understand the process and implications for digital development.

Early 20th Century

The influence of real estate developers began in earnest after WWII,

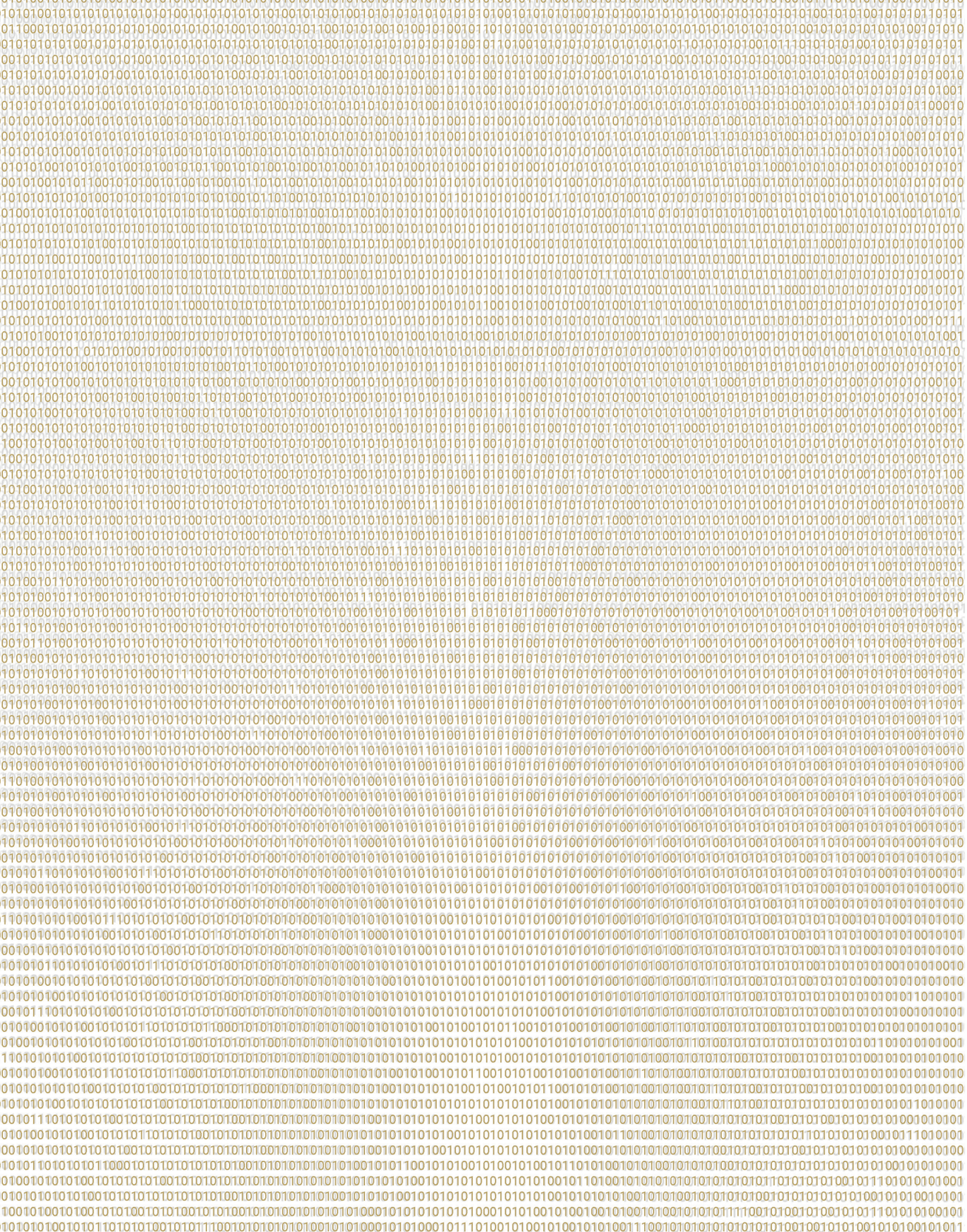
during a period of suburbanization and urban renewal (Stevens, 2016). In tandem, all levels of government have a long tradition of involvement in urban land development and renewal in both Canada and the US (Eidelman, 2016). In these early years, real estate developers often used moral arguments to convince politicians and planners to consider their projects, espousing the benefits to citizens' quality of life and civic pride (Stevens, 2016). Developers building in the 1960s were arguably more publicly-minded than those that came later, as they paid careful attention to neighbourhood-scale urban design and the inclusion of urban amenities, such as green space, into their projects (ibid).

These considerations were never wholly separate from the monetary bottom line, however. By the middle of the 20th century, the built environment as capital began to be influenced by finance, although ideas of free market capitalism were niche among real estate developers until the 1970s (ibid). Seeking to derive public benefit from developers' need for profit, New York City enacted incentive zoning in the 1960s, which has since become commonplace in North American cities. Incentive zoning allows developers to build higher and denser if they provide an amenity, like a public plaza or arcade (Whyte, 2012). New York City, and the cities that followed suit, gained public space in dense downtown areas, which invariably benefited the public. Today these types of spaces are known as POPS, or privately-owned public spaces. Not all this public space was well-designed, however, and some have prohibitive rules around behaviour or even security guards that monitor the space (Németh, 2009). The entanglement of real estate development and public space became more explicitly monetary as the profession developed.

Late 20th Century

Real estate development changed with the introduction of neoliberalism as the dominant economic order in the West in the late 1970s and 80s. Its spread is tied to the policies of President Reagan in the United States and Prime Minister Thatcher in the United Kingdom. Neoliberalism's organizing principle is free market competition; accompanying characteristics are deregulation and minimal government intervention, a belief in the necessity of continued economic growth, and a commitment to free trade (Smith). The growth of financialization, where value is produced through exchange or claims to future growth rather than through the production of goods, has accompanied the rise of neoliberalism (Brenner, 2014). Real estate development under neoliberalism prioritizes profit; it is also intimately tied to economic growth cycles, as evidenced in the 2008 subprime mortgage crisis (ibid).

To generate the necessary economic growth, North American cities invested in their downtowns to attract and secure business (Stevens, 2016). Then and now, being municipal governments aim to be globally competitive in this regard to secure prosperous futures for their regions (ibid). While buildings and infrastructure are clearly important in doing so, parks and other urban public spaces "began to be viewed as mechanisms for driving economic development and reinvigorating downtown districts" (Larson, 2018, p. 397). Governments have been using spending and incentive programs, financial tools, and tax incentives to encourage greater engagement by the private sector in urban revitalization (Small & Miller, 2002). These practices further encourage developers to extract profit from urban real estate development (Stevens, 2016). The extra incentives offered by municipal governments were not only to simply encourage real estate development in downtown areas, they were often seen as necessary compensation by developers taking on risk developing polluted brownfield sites common in post-industrial urban areas (Small & Miller, 2002). Either way, profit and growth became central to the practice of real estate development under neoliberalism.



Big Data

Big data "refers to the availability of massive amounts of machine-readable information" (Offenhuber & Ratti, 2014, p. 7). Digital technology has precipitated the direct and indirect generation of this data through social media, cell phones, credit cards, smart meters and sensors (Arup & RIBA; Offenhuber & Ratti, 2014). Social media provides a platform for data generation through text and images, while a multitude of technologies produce data about physical space and human interaction with and within it. For example, mobile phones generate huge data sets on citizen's movements through the city. All this data is simply the "digital exhaust" of our everyday lives (Offenhuber & Ratti, 2014, p. 7).

One of the factors contributing to the excitement around big data is the insights it can provide on people, infrastructure, environmental quality, and the interactions between the three. Municipal governments use insights from big data to plan and manage city services, usually to save money and improve efficacy (Arup & RIBA). Big data can also be used to improve the built environment. Designers can use data like observational research would traditionally be used: to understand how people use and feel about urban spaces in order to improve their design (ibid). As well, data can be deployed to help people make sense of the space they are in (ibid). It may also be used to create simulations and experiments to test different design options (ibid).

While big data has the potential to improve cities, it also raises concerns over ownership and privacy. While early concerns with big data mostly focused on data collection, like who can do so and when, the conversation has shifted to concern over who owns and controls all this data (Offenhuber & Ratti, 2014). Methods of data collection influence the data collected, which can bias the results of analysis (Scassa, 2018). Consider, for example, using posts on social media to understand people's feelings about a public space; this method of data collection excludes those who do not own smart phones, computers, or have social media that may also use the space. Data ownership issues arise when data is used for commercial means and when it interferes with the right to privacy (Scassa, 2018). Data can also be used for political means, as campaigns can use data to understand who their voters are and target them specifically (Illing, 2017). Should those who generate the data have control over its use and when it is deleted (Offenhuber & Ratti, 2014)? These are serious concerns in the development of the smart city.

Fig 3. Big Data (opposite)

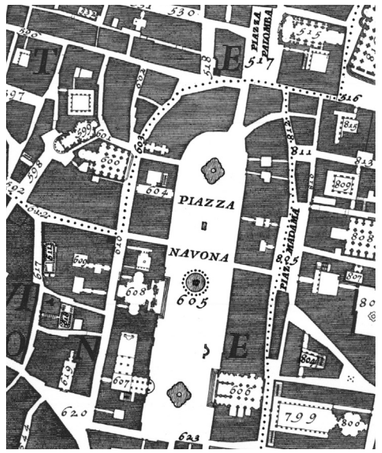
Technology and Space

"Space does not reflect society, it expresses it, it is a fundamental dimension of society, inseparable from the overall process of social organization and social change. Thus, the new urban world arises from within the process of formation of a new society, the network society, characteristic of the Information Age." (*Castells, 2004, p. 419*)

As technology alters the way society functions, it alters the way society produces space. This occurs through means of technological representations of spatial data, the understanding of space through technology, and its organization by technology. Now, the Internet of Things is forging a novel relationship between technology and space, where physical objects embedded with sensors and digital technology collect data and exchange information (Burgess, 2018). These smart objects are the basis of the smart city, which utilizes them to provide services to citizens, attract businesses, and develop innovative industries (Hollands, 2008).

Mapping

The idea that data can be used to develop new possibilities for the city began with mapping (Offenhuber & Ratti, 2014). Giambattista Nolli's well-known plan of Rome, published in 1748, contains astonishing levels of accuracy, which he was able to achieve using a magnetic compass (Ceen). It also includes detailed data on the city, such as the presence of small fountains or colonnades (ibid). The Nolli map is so accurate, it was used until the 1970s as a base map for planning by the municipal government of Rome (ibid). Mapping was also used in other contexts, such as when the doctor John Snow placed data points on instances of cholera on a map of London in 1854 to locate the source of the disease, a contaminated well



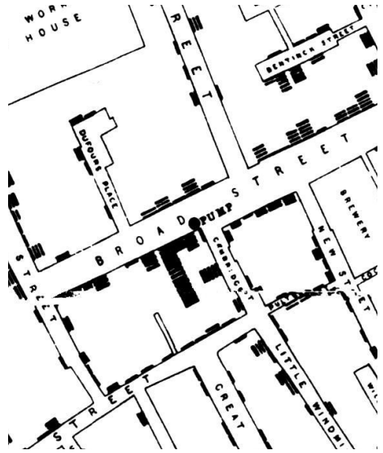


Fig 4. Nuova Pianta di Roma. (*left*)
Giambattista Nolli, from Wikimedia Commons

Fig 5. Cholera Map. (*right*)
John Snow, from Wikimedia Commons

on Broad Street (Bynum). Now, we created maps using GIS, satellites, and data collected and compiled by various actors, such as scientists, municipalities, and the general public. Multitudes of layers of information can now be easily included in these maps, and spatial understandings drawn from the relationships between them.

As James Corner argues, the act of mapping creates and shapes everyday space as much as it describes it (1999). Therefore, maps created through certain technological means or by plotting specific data sets will influence the construction of the space that is mapped. As Kitchin and many others have noted, data can have error, bias, or uncertainty depending on the technology used for collection, the method of collection, or human error or assumptions (2014). In this situation, error, bias, or uncertainty would be introduced into the map, and therefore our conception of the space. By using maps as the basis for future spatial possibilities, designers could transfer those concepts into space.

Systems Thinking

Digital technology and the proliferation of data is also tied to turn toward understanding landscape as a system, which began with cybernetics in the 1960s. Cybernetics is "the study of communication and control in living and mechanical systems" (Lystra, 2014, p. 71). The study of cybernetics began earlier during the Second World War, as scientists incorporated ideas about feedback in complex systems into building an anti-aircraft machine that would anticipate the movements of enemy planes (Lystra, 2014). By the 1960s, biologists were using cybernetic analogies to understand the behaviour of living organisms (Fernandez-Galiano, 1982). At the same time, pioneering landscape architects like Ian McHarg and Lawrence Halprin would adopt cybernetic ideas when dealing with landscape change in design (Lystra, 2014).

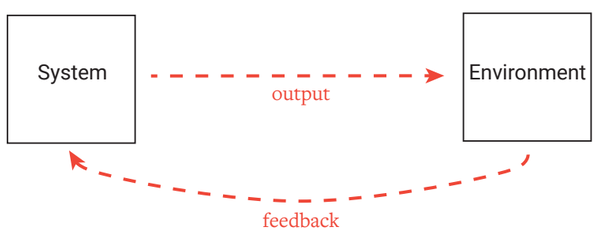


Fig 6. Cybernetic Control and Communication

Systems thinking became the dominant method of understanding the world; the philosopher Ivan Illich argues we officially entered the age of systems in the 1980s, leaving the age of tools behind (2005). The fundamental difference between the two is that tool users maintain a separation and control over the tool, but "when you become the user of a system, you become part of the system" (Illich, 2005, p. 78). This has implications both for how space is constructed, as well as for how people are caught up in digital systems. In the age of tools, the relationship between technology, humans, and space was thought of as acting in one direction: humans used tools to shape space. In the age of systems, we understand this relationship differently, as a nexus of the three. The murky entanglement of technology, humans and space has engendered an academic debate that asks if humans are locked in a sociotechnical system inevitably created by technological development, or whether technological development is mediated by sociocultural factors (Braham & Hale, 2007). It is more likely that neither position is absolutely true. As Castells stated in the quotation at the start of this section, space is inseparable from society (2004). Since technology and space are also intertwined, we can understand the relationship as a nexus, where technology, space, and society co-create each other.

The Organization of Space

Within this nexus, digital technology can shape the organization of urban space and society. Marshall McLuhan developed the basis for this theory in the 1960s, when the television was the latest consumer technology (McLuhan, 1997). His famous dictum, "the medium is the message", posits that "it is the medium that shapes and controls the scale and form of human association and action" (ibid, p. 152). According to McLuhan, technology's ability to act on space is a result of its being an extension of the human sense and perception of the world, and its compression of time (ibid). While he writes primarily of media technologies like print, telephone, radio, and television, he also includes money in his analysis of technology's influence on human perception. Money affects how we organize the world, as now do personal computers and smartphones (Castells, 2004). The ability of digital technology to communicate information instantaneously has shifted our perception of space and time as made up of sequential, interlocking parts to a perception that things are fundamentally connected in a ubiquitous field (McLuhan, 1997). Decentralization, discontinuity, and diversity characterize spatial arrangements (ibid).

Manuel Castells noted a similar trend in the organization of urban space

in his spatial theory of flows and places. He theorizes that cities are composed of spaces of flows and spaces of places, each with different social characteristics determined by information technology. The space of flows is part of a global network enabled by digital technology, more than it is part of the city in which it is located (Castells, 2004). It is usually a small, nodal area in the city that has outsize economic importance (ibid). Downtown business districts and financial centres are spaces of flows. As a result of their global importance, these spaces receive lots of investment and careful management (ibid). The space of places, in contrast, is fundamentally local. Its organizational logic and programming are that of the city itself, its culture, and its citizens (ibid). The totality of the city is structured by the competitive relationship between the space of flows and the space of places. The advent of the smart city, however, is overlapping the two so they are physically the same space, although each retains its original logic (ibid). At this moment, Castells , like McLuhan, sees a resulting trend towards diversity, fragmentation, and individualization in space and culture (ibid).

This instant, diverse, decentralized city will be held together by communication among its spatial fragments. Castells understands urban public spaces as shouldering this vital role (ibid). They allow for cultural communication, as well as spatial connections between fragments. He notes, however, that these kinds of urban public spaces have been threatened by increased privatization and the growing importance of the space of flows (ibid). Here, neoliberal real estate development practices contribute to the issue. Castells calls for designers and urbanists to explore the relationships of physical layout, society, and electronic networks, as well as the role of time (ibid).

Internet of Things

The smart city will be built on the Internet of Things. While term ‘smart city’ is often vaguely and contextually defined depending on the application of ‘smart’, which can mean sustainability, the promotion of information and creative industries, e-services, or various combinations, there is no doubt that it is enabled by digital technology (Hollands, 2008). The infrastructure of the city is the connected ‘Thing’; it will be able to regulate itself based on information it collects about its own state and the larger system of infrastructure (Offenhuber & Ratti, 2014). While a fully connected system of smart urban infrastructure has yet to be realized, companies are actively developing the technology in partnership with municipal governments. Songdo, South Korea and Masdar City, UAE, the two smart cities that have been built in the world thus far, are both actively developing

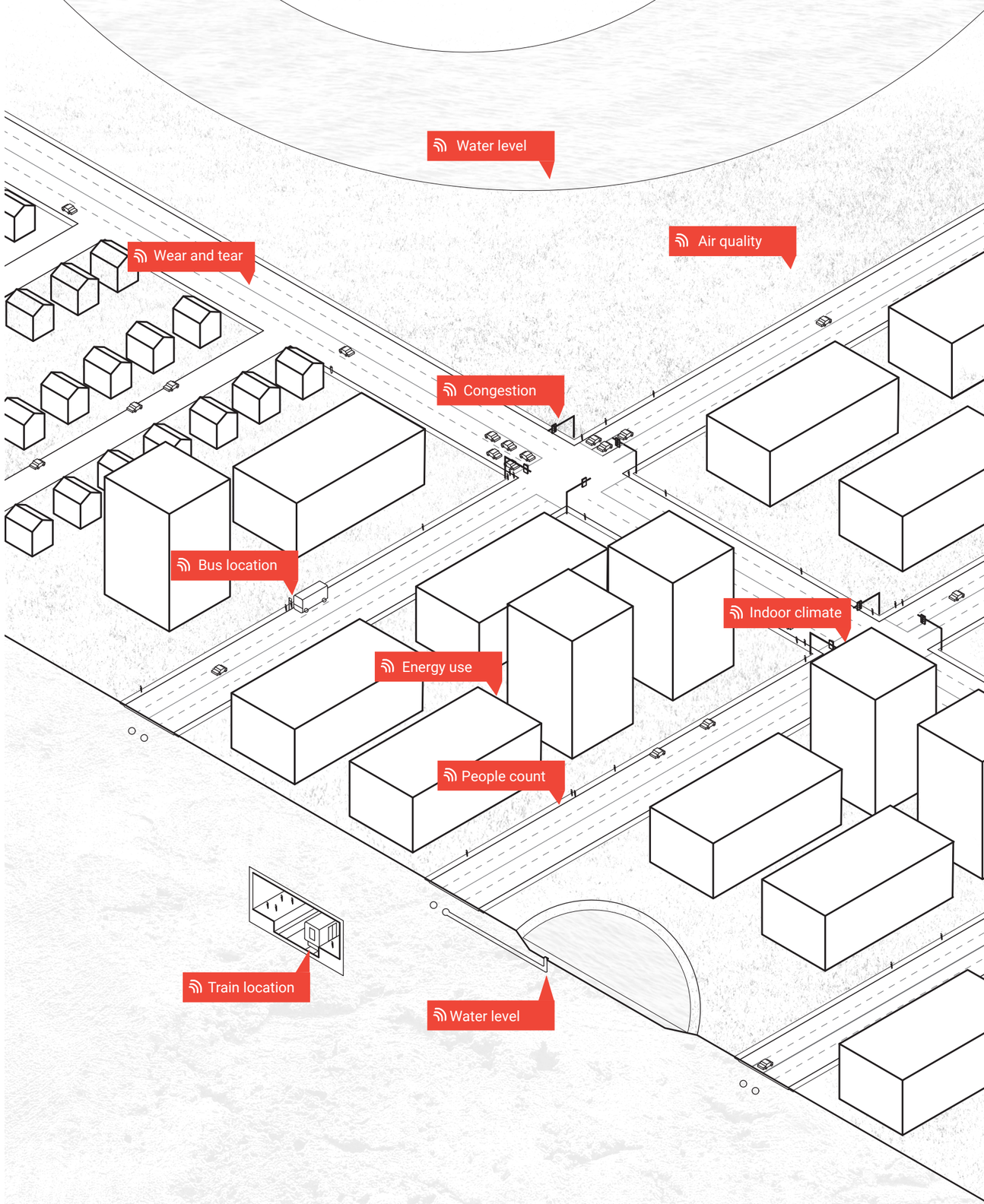


Fig 7. The Internet of Things (opposite)

partnerships with technology companies such as Huawei and Cisco to prototype Internet of Things technology. The public spaces in these developments were designed according to sustainable, new urbanist principles. Songdo, centred around a large park, was designed to encourage people to walk or bike within the community; Masdar employed traditional Arabian urban design techniques with mid-rise buildings to create a pleasant streetscape (Lee, 2016; “South Korea”). These spaces are not necessarily successful, however; in Songdo, despite the amenities in public space, people struggle to build community and often drive to nearby Seoul (Poon, 2018).

Fig 8. Masdar, UAE
John Echlin, 2011

The Internet of Things is revolutionary partially as a result of the sheer amount of data it will produce, both on its own state and the behaviour of those who interact with it. This data is a huge new source of value for cities, as well as posing privacy and security concerns. The privacy concerns result from the ability to use the data to infer the behaviour of citizens and questions of ownership and control. On a more sinister note, smart infrastructure provides the state a means to surveil its citizens (Hollands, 2008). Also, as with the Internet, it would be possible to hack the communication network on which the Internet of Things would rely. Governments and technology companies are both working on addressing the potential pitfalls associated with these issues in order to deploy this networks of sensors and other technologies throughout cities (ie. Fussell, 2018). Fundamentally, the development of connected objects opens up a new relationship between technology and space. Rather than constructing space at a theoretical level, digital technology embedded in physical objects alters it from the ground up. Although the full capacity of the Internet of Things is largely theoretical at this point, it will clearly be revolutionize how humans experience the world.

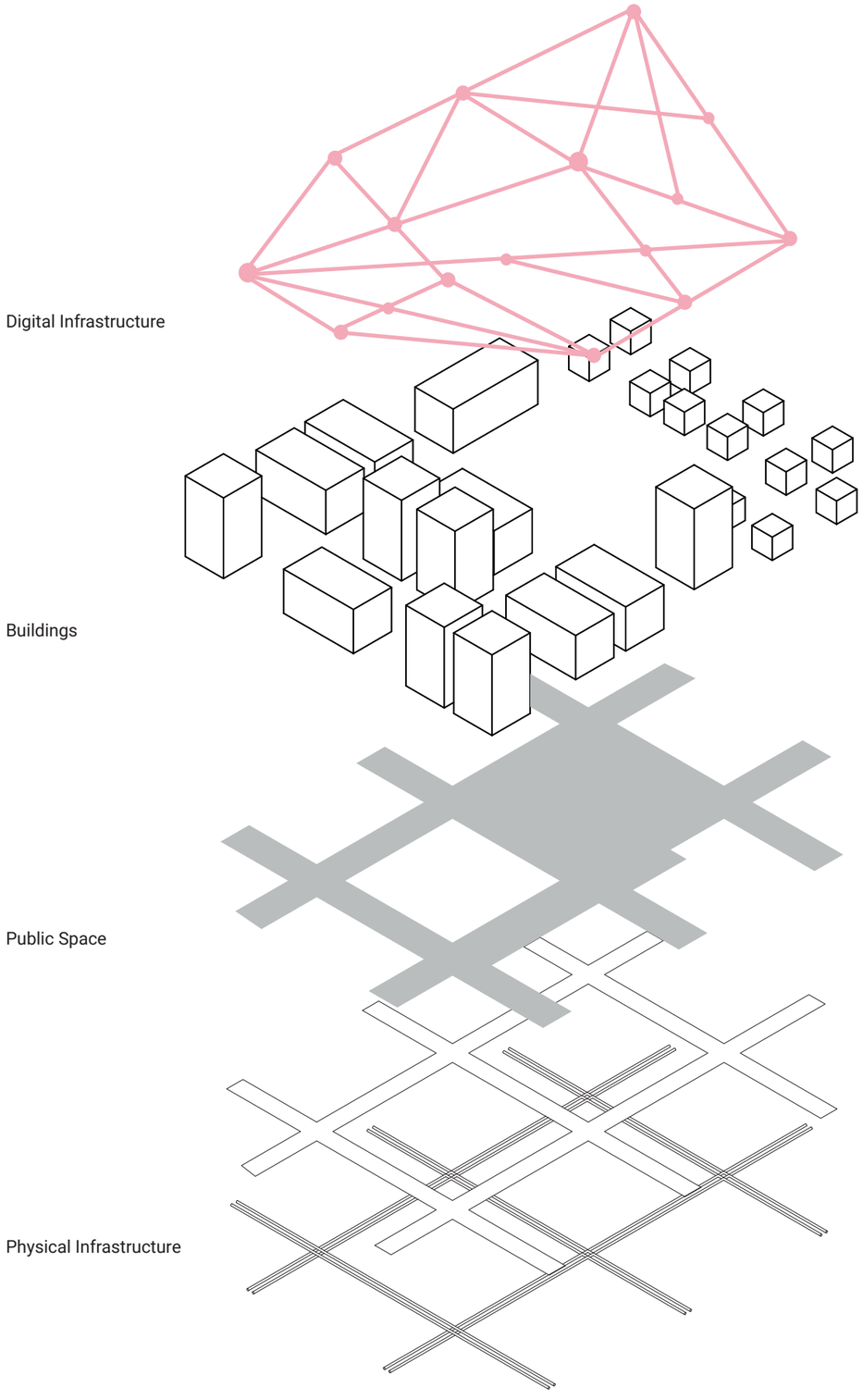
Fig 9. Songdo, South Korea
From Flickr Commons

Development of Digital Space

As the technology that becomes increasingly sophisticated, technology companies and real estate developers alike are capitalizing on the growing smart city market. Internet technology companies like Amazon and Google, are investing in projects that pair their technologies with physical space. Amazon has partnered with Lennar, the largest home construction company in the United States, to outfit new homes with Amazon's Alexa home assistant technology (Donnelly, 2018). Google is expanding its advertising business into public space by using data to pair ads on billboards to consumers in the space (Webb, 2018). As well, it has developed a spinoff sister company, Sidewalk Labs, whose focus is urban innovation technology. Sidewalk Labs is currently planning a smart city development, as well as investing in and incubating start-up companies that make smart city software. Large technology companies like Microsoft, IBM, Cisco, and Intel are the major players in the smart city game, however, and are actively jockeying to provide the hardware and software needed to power smart cities. Clearly, technology companies see value, potentially $151 billion according the market estimates, to be extracted from embedding technology in space (Columbus, 2018).

In partnership with technology companies, real estate developers are also investing in building smart cities. While most smart city projects embed technology in the existing physical space of actual cities, two greenfield smart city developers have been built thus far, with more in the planning stages. Songdo, South Korea and Masdar, UAE were both conceived as free economic zones where the smart city moniker would attract investment. Streamlined digital services, such as e-government and ubiquitous high-speed WiFi, along with the usual financial incentives are used to entice business to these locales ("South Korea"; Shelton et al., 2015). Songdo and Masdar, however, are more like platforms upon which to test smart city technology, rather than integrating multitudes of smart city functions from the outset. Some theorize that smart city developments are fundamentally marketing strategies using narratives of technological progress to drive economic growth and attract capital and labour (Shelton et al., 2015). As technological capabilities advance, however, more of these developments will begin from the Internet of Things, incorporating threads of digital technology into the spatial fabric. It will serve as another method of value extraction from the land, and thus understood as a new form of development (Bliss, 2018).

As a result, the development of digital space that will shape cities and their public space, current and future. The development of digital space combines



the traditional influence of real estate developers on cities with the ability of sociotechnical systems to construct space. This neoliberal system driven by private interests portends a ubiquitous digital urbanization that shapes our interactions with the city, and therefore urban society. The future of urbanism, as Koolhaas predicted in 1995, is predicated on the discovery of hybrids and the manipulation of infrastructure to continuously reinvent psychological space. His prediction is currently unfolding. The digital and the spatial are compressed; the space of flows is the space of places. As Castells and McLuhan noted, urban spatial organization will be decentralized, fragmented, and diverse. This fragmentation can be translated as gentrification, as smart cities marketed to global knowledge workers and the creative economy spatially disenfranchise poorer, technologically illiterate locals (Hollands, 2008). The balance of power is further skewed by the ownership of big data, as it is extracted from everyday citizens and controlled by tech companies and their knowledge workers. Urban public spaces are the battleground of the contentious relationship of public and private interests in the smart city, and their increasing control by private interests threatens the vitality of public life.

Implications

No one could argue that contemporary cities aren't facing major issues. Aging infrastructure, growing populations, a changing climate, increasing income inequality, and inadequate budgets plague many North American cities (Harcourt & Seymoar, 2017). Through the insights of big data and the power of digital communications technology, cities can gather the information and achieve operational efficiencies that help solve issues. Similarly, the flat governance structure of Internet was revolutionary for global communication and has allowed people to easily communicate with others and interact with institutions (Mitchell, 2002). As most know about the Internet, however, these benefits are not without liabilities.

As already discussed with respect to big data, there are concerns over ownership and personal privacy. When data collection becomes a method of urban value creation with the rise of the development of digital space, these concerns enter the everyday lives of citizens. The tension between the interests of private companies and the citizenry is most tangible in urban public spaces; they are increasingly tied to development interests or funded and built by developers, and yet are the backbone of public life in the city (Castells, 2004; Németh, 2009). Can citizens be sure that their privacy will be respected, in order

Fig 10. The Development of Digital Space (opposite)

to engage in democratic activities in public spaces? Will the repercussions of their actions remain their own, or will the data on their actions be co-opted for private interests?

The development of data space also raises larger concerns about equity in society. North American cities are experiencing high levels of income inequality, which is reflected in the physical spaces they occupy (Moore & Schindler, 2015). The development of data space could be the latest iteration of investment in the space of flows, as cities seek to be globally competitive and attract the elite creative class (Castells, 2004; Shelton et al., 2015). The value from the data extracted from urban public spaces could also accrue solely to the elite, those who are shareholders in technology and real estate development companies. This could be considered a new, nuanced form of exploitation. On the other hand, smart cities could improve quality of life for all citizens in society and increase service provision to those most in need of them (Arup & RIBA). Again, urban public spaces and infrastructure will play a key role in ensuring equity to citizens. The question for design, then, is how to thoughtfully work with digital constructions of space and address the social issues inherent in these smart developments.

Conclusion

Public spaces are vitally important to cities. They are spaces for citizens to recreate, engage in democratic life, and consume goods and services. These societal roles are evolving with the incursion of the Internet and digital technology into the private and public lives of citizens. The construction of the physical public space itself is tied to the neoliberally-driven private interests of real estate developers and municipal governments, causing the proliferation of privately-owned public open space. These public spaces are often, but not always, poorly designed and subject to behavioural rules not present in publicly-owned open space. With the global rise of the urban Internet of Things and the importance of big data in management and planning, digital technology is shaping urban space. The technology we use to sense and understand the spaces we inhabit influences that very understanding, which began with the practice of mapping and has evolved with digital communication technology to connect and compress space and time. Digital technology has reorganized the city, creating a global space of economic flows that exists simultaneously and in contrast with the local space of places in the city.

In the hands of large corporate interests, the Internet of Things and the smart city paradigm begets a new form of development where digital technology is integrated into urban infrastructure as a method of value extraction in the form of big data. This could benefit the city by decreasingly management efficiencies and increasing engagement with planning and design. Concurrently, debates are being waged over issues of data ownership and control, and its effect of the private life of the citizen. Inequality, power imbalances, and gentrification may all increase if data and the ownership and planning of the spaces that collect it are given over to private interests. These spaces are also utilized by developers and cities as marketing to attract business, investment, and elite knowledge workers. The future role of urban public spaces and the future city itself will be formed from this clash of competing public and private interests, both molded by digital technology and its role in the global economy.

Design Proposal

This design proposal engages urban public space and digital development. It seeks to understand the operational methods of digital development and consequently how those methods affect physical space. Through this understanding, digital development can be co-opted, subverted, or appropriated to create meaningful urban public spaces, realizing benefits to citizens while mitigating the negative implications of this novel method of development. Within this project, meaningful spaces are defined as those that serve the needs of the surrounding community and engage with the contemporary roles of public space. Within the proposed public spaces, synergies between connected, smart infrastructure, big data, and spatial design will be created.

The design methodology utilized will seek to mirror the content of the proposal. Most tools used by contemporary landscape architects and architects to produce design work are computer-based. The 3D modelling software, GIS-based applications, programming languages, and image editing programs have an influence on the design outcome, just as the technology used to understand space influences our perception of the space itself. In using these programs, designers are creating and manipulating data in service of design, and this method changes the very thought process of design (May, 2017). Thus, the project seeks to critically and thoughtfully employ these tools in understanding and designing digital development.

Finally, this design proposal will do so by engaging with the Sidewalk Toronto project. Sidewalk Toronto is a hybrid organization of Sidewalk Labs, Google's urban innovation sister company, and Waterfront Toronto, a tri-government body tasked with the revitalization of Toronto's waterfront ("About"). Sidewalk Toronto has proposed Quayside, a model sustainable, smart city development "from the Internet up" on the city's eastern waterfront (Sidewalk Toronto, 2017). Quayside has been embroiled in controversy over issues of big data, privacy, public engagement, and the influence of large corporations in civic life (ie. Balsillie, 2018; Fussell, 2018; Galang, 2018). In contrast, their urban design and public space proposals are standard and unexciting, with a hint of corporate new urbanism (Bliss, 2018). How could Quayside, and indeed the entire Port Lands initially included in Sidewalk's initial proposal, be subverted and reimagined for the benefit of the citizens of Toronto?

Site

Toronto's Port Lands are a largely underused section of Toronto's waterfront that hosts a smattering of light industries and the city's only working port ("History of the Port Lands"). It houses facilities for the import and storage of road salt and construction materials, power generation, and the film industry ("Port Lands Planning Framework"). Where the Port Lands now sits was once a large freshwater marsh that was created by the confluence of the Don River and Lake Ontario ("History of the Port Lands"). This changed in the early 20th century, when the marsh was filled in to create new land for an industrial district (ibid). The mouth of the Don River was redirected at a 90° angle to flow through a concrete channel to make way for the new land, which greatly increased its flood risk (ibid). The land has been underutilized since the 1980s, when it was clear it would never become a major hub of shipping and industry (ibid).

The revitalization of the Port Lands, also known as the Lower Don Lands, was the subject of a 2007 design competition won by Michael Van Valkenburgh and Associates ("Project Timeline"). The team's project, titled 'Port Lands Estuary', has been guiding master plan behind the extensive planning of flood adaptation and mitigation infrastructure that has occurred since (ibid). The site's flood risk makes this infrastructure necessary and it must be completed before later stages of redevelopment can occur. With the announcement of government funding in mid-2017, construction began in December of that year and is expected to continue until 2023 (Hume, 2017; "Construction"). Construction in the Port Lands includes parks, earthworks and flood protection, roads and bridges, and

Fig 11. Site Map
Map Data: Google, TerraMetrics

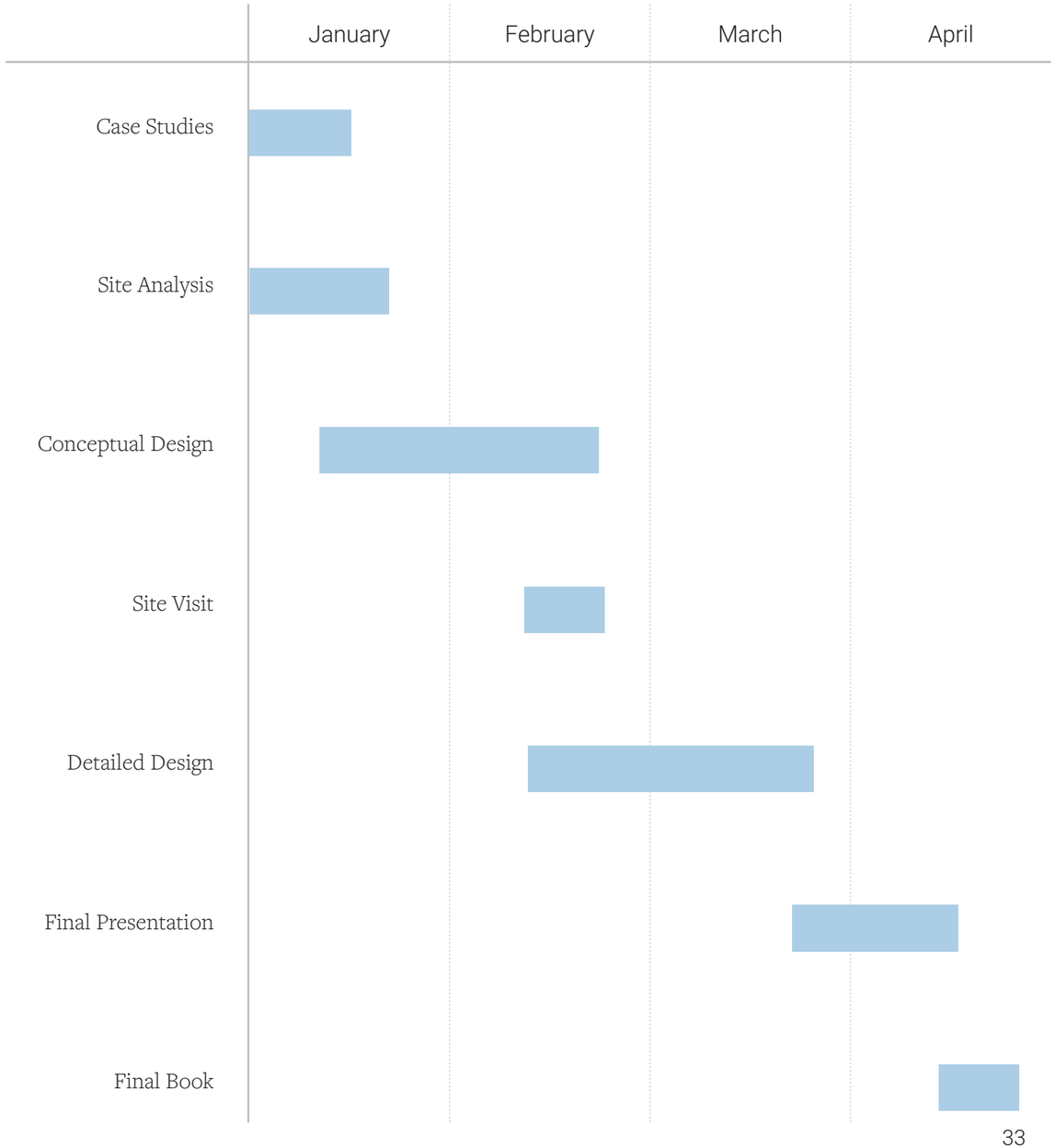
Fig 12. Eastern Portion of Quayside Site
Map Data: Google

other municipal infrastructure (“Breaking Down”).

Future programmatic uses of the Port Lands are still in the planning stages. Quayside itself is intended to be mixed use, with high rise timber buildings holding apartments, retail, offices, and small-scale light industry. The ground floors of the buildings will have ‘Stoa’, the name Sidewalk Labs has given to vague plans for digitally innovative flex space that could be used by businesses, entrepreneurs and community members (Sidewalk Toronto, 2018). The current land use plan for the Port Lands envisions multiple distinct mixed-use neighbourhoods on the site for residents, employers, and tourists (“Port Lands Planning Framework”). New parks and events spaces will mix with existing industry; the film industry that currently resides there will expand into a new district with the moniker ‘Media City’ (“Section 3”).

Sidewalk Toronto’s smart city vision for Quayside is multi-faceted. The recently released Draft Site Plan indicates they plan to use digital technology for e-services and management, to meet sustainability targets, and attract and foster businesses. Digital management proposals extend from the streets, which will change over the course of the day to accommodate various transit modes and programs, to underground robotic delivery systems. Sidewalk Toronto has even proposed an app that ‘optimizes space programming’ in the public realm (Sidewalk Toronto, 2018, p. 25). Digital management is also used to meet sustainability targets by recovering waste, actively managing stormwater, and building energy management. As well, renewable energy sources and timber buildings are proposed to reduce the development’s carbon footprint. Sidewalk Toronto plans to utilize their development to innovate within the Canadian timber construction industry. Quayside also plans to host an ‘Urban Innovation Institute’ which ‘will draw entrepreneurs and companies from around the world’ (ibid, p. 23). Even though Quayside touts myriad digital innovations, the current plans for the design of public space seem less so. The design project seeks to engage the design of public space in this digital development to ensure benefits to the community.

Plan of Work


January
February
March
April
Case Studies
Site Analysis
Conceptual Design
Site Visit
Detailed Design
Final Presentation
Final Book

Programming Place

Design

This design project engages with the smart city by proposing a public space template that enables the agency of the citizen. Here, agency is conceptualized as freedom of choice and the ability of citizens to build community on the site . It seeks to experiment with questions raised by the smart city, such as the blurred nature of public and private space, the hierarchical relationship between Sidewalk Labs and the citizen, and the extractive nature of behavioural data collection by private companies. To address these concerns, the philosopher Hannah Arendt's thinking on the nature of the public realm is taken as inspiration for the programming of the space.

Fig 13. Hannah Arendt
Unknown, 1975

Hannah Arendt and the Public Realm

Hannah Arendt was a Jewish-German philosopher and social theorist writing in the mid-20th century. Her body of work is eclectic, defying disciplinary boundaries and spanning totalitarianism, human nature, and the effects of the rise of scientific thinking on the human experience. As such, she is primarily categorized as a political philosopher and a phenomenologist, one who deals primarily in the theory of beginnings (Canovan, xix; Allen, x). In her book *The Human Condition*, Arendt examined the separate roles and characteristics of one's public and private lives, leading to a theory of the public realm.

For Arendt, what is public is the fabricated by and between humans, while the private realm is traditionally that of the individual household (1958). The public realm, therefore, is a common world where phenomena can appear and exist from

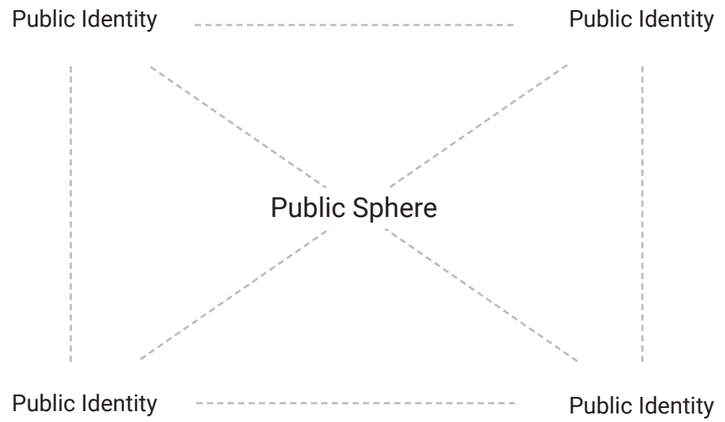


Fig 14. The Public Realm

subjective viewpoints of the many (Arendt, 1958). The presence of others in the public realm helps one define one's identity, while the interaction of multiple identities creates the public realm. It transcends any individual lifespan, sustained through continuous human interaction (ibid). Arendt breaks down human interaction into its component parts: action and speech. Both are inherently political , and in early Western philosophy were once considered one and the same (ibid). Speech is rhetoric, a tool of persuasion. Action is the ability to create a new beginning, one that follows an unpredictable path as it resonates through the human connections that constitute the public realm (ibid). It is through acting and speaking in the presence of others that one discursively formulates a public identity, and in doing so creating and strengthening the public realm.

In *The Human Condition*, written in 1958, Arendt outlined observations on the human experience and the public realm that remain relevant and clarify the inclusion of her thinking in this project. She noted the rise of private, individual concerns into the public realm, blurring the meanings of public and private for the human (ibid). This has paralleled the rise of society, a form of human organization based in the private household and its concerns. Like the private household, it also necessitates conformism to a singular way of running and understanding matters (ibid). In society individuals are kept in line by an agreement on common interests, common opinions, and common ways of acting (ibid). This is behaviour, not action. Behaviour precludes the possibility of real action as it is impossible to make a new beginning when an agreed upon suite of actions is continuously repeated. According to Arendt, 'behaviour has replaced action as the foremost mode of human relationship' (ibid, p. 41). Under these conditions, the public realm withers as phenomena are 'seen only under one aspect and is permitted to present itself in only one perspective' (ibid, p. 58).

The dogma of the smart city solidifies these trends in the contemporary moment. It formalizes mass society through the usage of sensors that track human behaviour and environmental conditions, then creates and manages the city based on the analysis of the aggregate data. The sensors, with the large amounts of data they capture and analyze to discover trends, capture behaviour, not action. Even in the event of action, the practice of statistical analysis smooths the human experience into behaviour. The smart city is not the discursive public realm that Arendt describes, one that is created between people, but the society composed of isolated private experiences. It limits the human experience and isolates one from one's neighbour. The smart city removes citizens' agency to

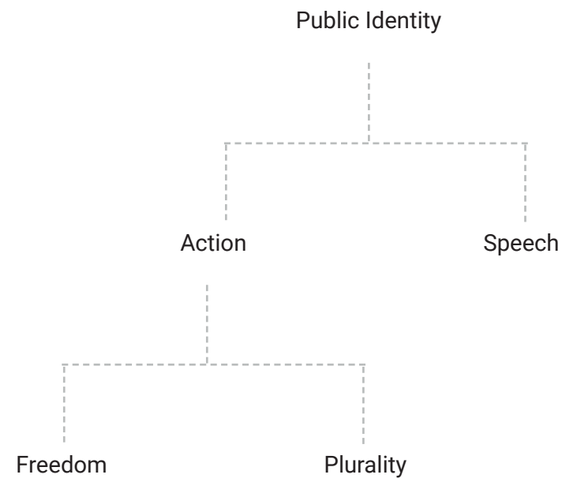


Fig 15. Public Identity

formulate a unique identity and construct a public realm from those identities by controlling the ways that humans experience the speech and behaviour of others.

In tackling the question of the smart city, it is imperative to focus on the development of the public realm and the agency of the citizen. The purpose of the technology embedded in the smart city is to improve the lives of its citizens. While data-driven solutions may make complex systems easier to manage, the quality of a citizen's lived experience, their freedom to construct a unique identity, the agency they have in conducting their own life, and the sense of belonging with their fellow citizens are equally as important. The design of the smart city needs to encourage the development of a vibrant public realm. By applying principles adapted from Arendt's thinking to the design of Quayside's public space, this design proposal provides a foundation for doing so. Arendt's thinking on the public realm and its component parts provided a framework for the programming of the space. In providing choices and opportunities for the citizens of Toronto in engaging with various activities and each other, they are given agency in shaping their experience on the site. The principles are as follows:

Performance of public identity
(Thuma, 2011)

The public space should enable the performance of citizens' public identities. It should enable speech and action in the presence of others in a way that cannot be captured and analyzed as data. Social media is not public identity. In light of the rise of the family unit into the public realm that Arendt identified, public identity can also be construed as family identity. Spaces for families to recreate should be included. Finally as a legal person and key actor on the site, Sidewalk Labs should also perform their public identity through the space.

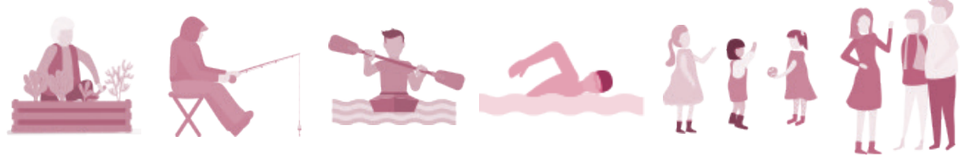
Opportunities + alternatives for action
(Thuma, 2011)

The ability to act is necessary for people to have agency in constructing their own identities and the public realm. Two components are necessary for action: the presence of other people and the ability to craft a new beginning. Therefore, a public space that provides opportunities and alternatives for action should attract and support a large and varied population of people, as well as provide open-ended programming.

Equality in communication + interaction
(Thuma, 2011)

For a public realm to be truly public, equality amongst citizens is vital. Everyone needs to be able to participate and be understood by their fellow citizens. The programming of the public space needs to be equally accessible to all across social, economic, and physical barriers. When people are equally engaged in an activity, it lowers barriers to communication.

Grounds for worldly experience
(Thuma, 2011)



Public space in the smart city should function as a place to experience the world constructed by and amongst people. Therefore, the programming of the space should be community-oriented in the widest sense of the world, as it should be inclusive of many different people and communities. The smart city expands the traditional definition of the human world, as it is now a cyborg that includes tech developers like Sidewalk Labs. As such, the public space should make apparent this relationship between Sidewalk Labs and the citizen.

Fig 16. Program Analysis
Map Data: Google, TerraMetrics

- Sport Fishing
- Boat Launch
- Community Garden
- Playground
- Indoor Pool
- Splash Pad/ Wading Pool

The surrounding area of Toronto was examined to understand where the intended programming of the site, swimming, playing, gardening, fishing, and boating, already exists. While pools and splash pads exist in the area, no outdoor swimming opportunities are present. There is a deficit of community gardens and boat launches in the area, as well as opportunities for fishing.

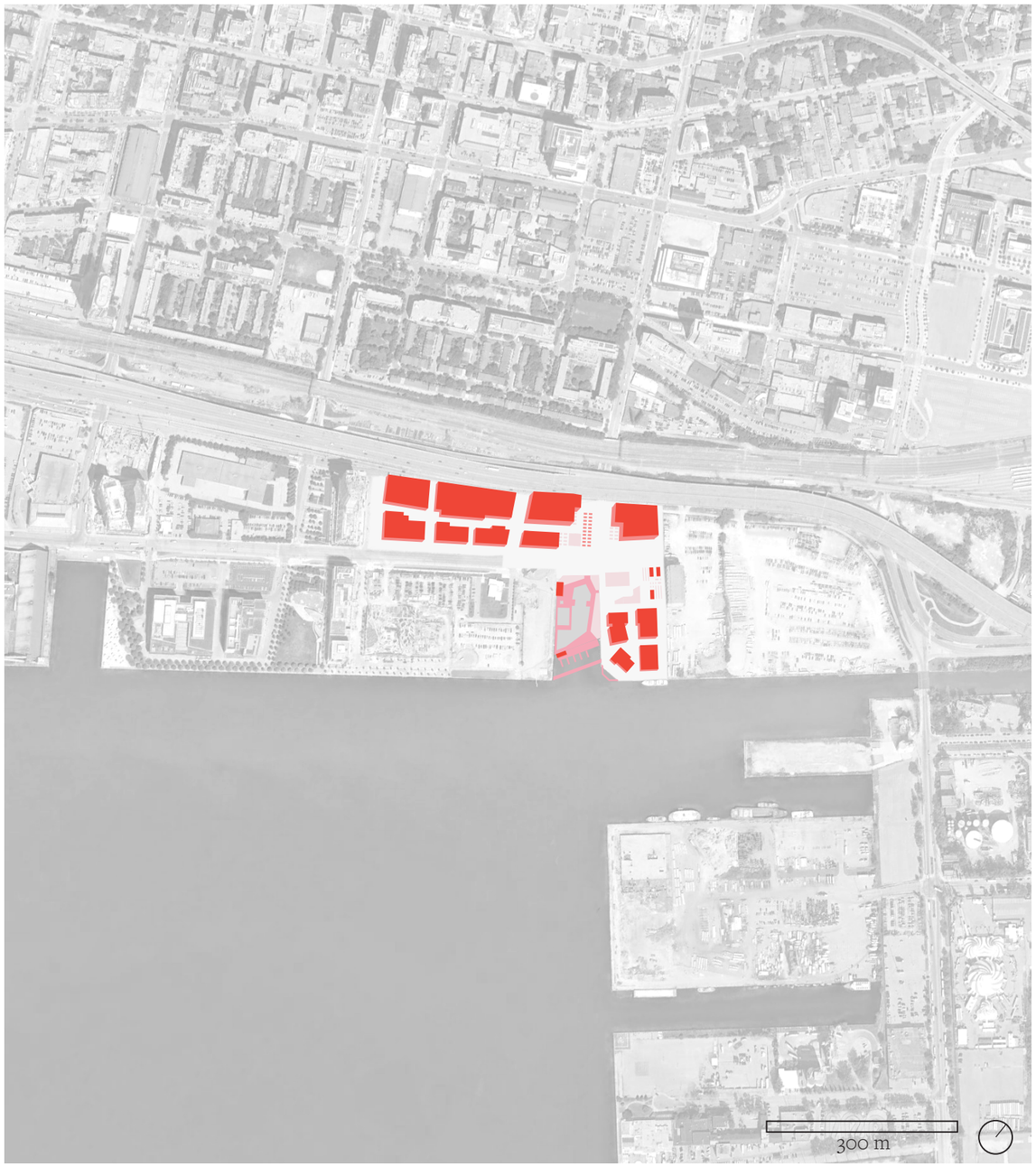
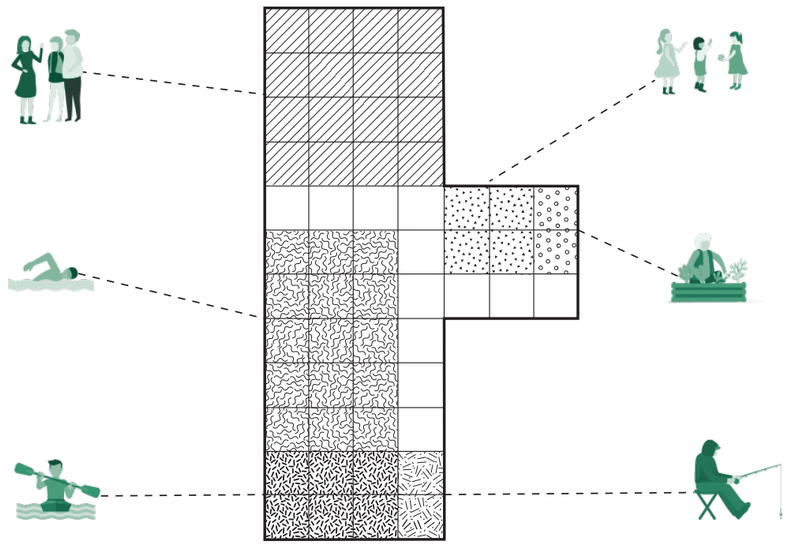


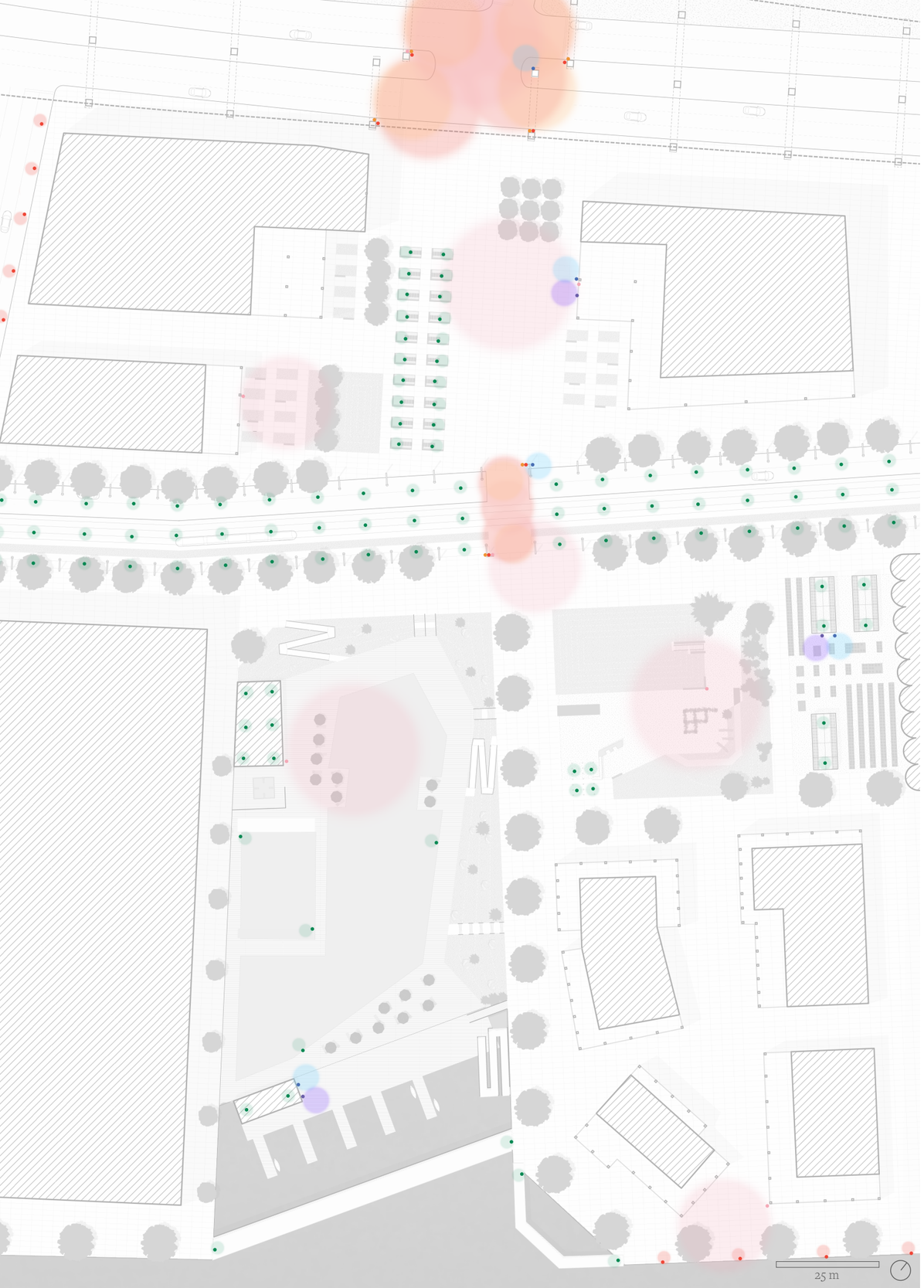
Fig 17. Design in Context
Map Data: Google, TerraMetrics

The proposed design is shown within the context of the Eastern Waterfront. The mixed-use high rise buildings proposed by Sidewalk Toronto in its *Draft Quayside Site Plan* are taken as given. The parcel under construction directly to the south-west of Quayside will soon also be home to high-rise condo



These program elements strengthen public discourse by providing equitable and communal opportunities for action, and for people to build and express their identity in tandem with each other, separate from digital platforms. This constellation of programs is laid out based on a grid across the site, creating a series of unique spaces and allowing for synergies between programs where they abut each other.

Fig 18. Design Plan (opposite)
Fig 19. Program Diagram



From this constellation of spaces and their programming, the digital programming of the space was defined by strategically placing different sensors in space. These are the sensors that Sidewalk Labs has already stated it will include in the development: air quality, hyper-local weather, vibration to monitor asset conditions, noise, radar and laser range-finding, and computer vision. These sensors will be used to gather information on the space and control it through feedback loops. To create categories of digital space from the sensors, axes were developed from Quayside's primary digital concerns and their binary opposites: public/private, controlled/ uncontrolled, and extractive/additive. In a public space all information can be gathered, while in a private space no personally identified information can be collected. The information from controlling sensors have the ability to change the space from which it is gathered, while uncontrolled space cannot be directly modified by data analysis. Extractive spaces produce data that should not be owned by Sidewalk Labs, as it could be personally identifying or intrusive for that space to be monitored, while additive spaces produce data that would be helpful in the hands of the community, government, or Sidewalk Labs. These qualities were used to evaluate the spaces on the site and determine where to place the appropriate sensors.

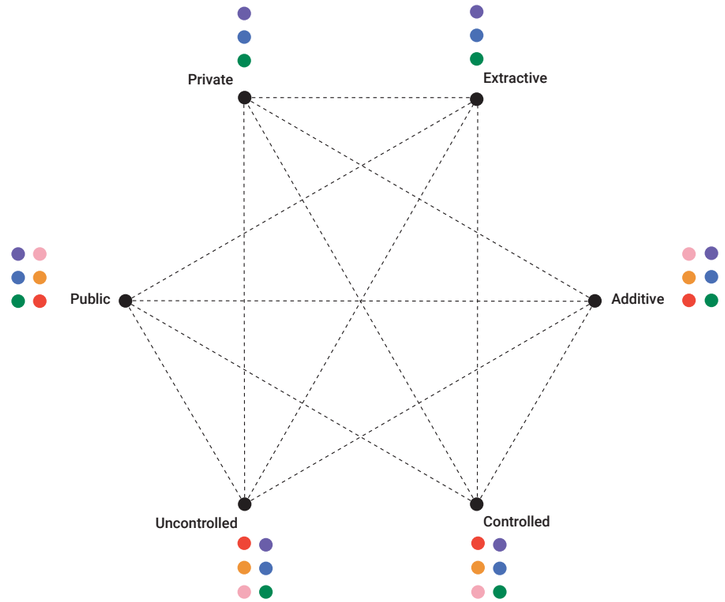
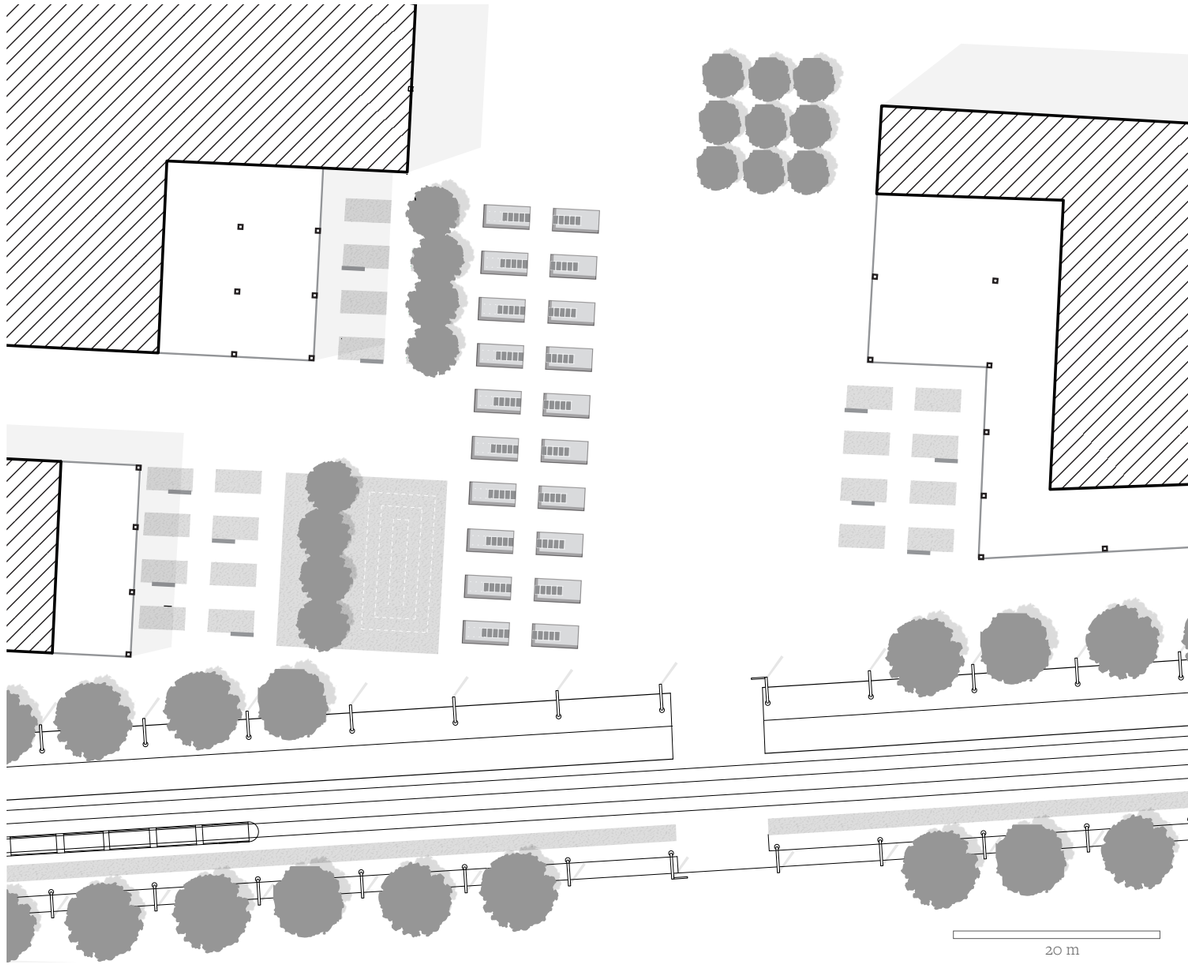


Fig 20.. Sensor Plan (opposite)
Fig 21. Sensor Organization

The plaza in the north adheres the most strongly to the grid, and is the most surveilled of the spaces. As it is the meeting point of different entrance axes to the site, it is programmed as a flexible events and meeting space. Computer vision and laser range-finding are used to automatically manage the intersections. It also houses the servers that would need to be located on site to process and analyze data from the site in real-time. These servers are located in a glass-ceilinged room underneath the plaza, so the activity underneath is apparent and people can be immediately aware of the digital nature of the space.



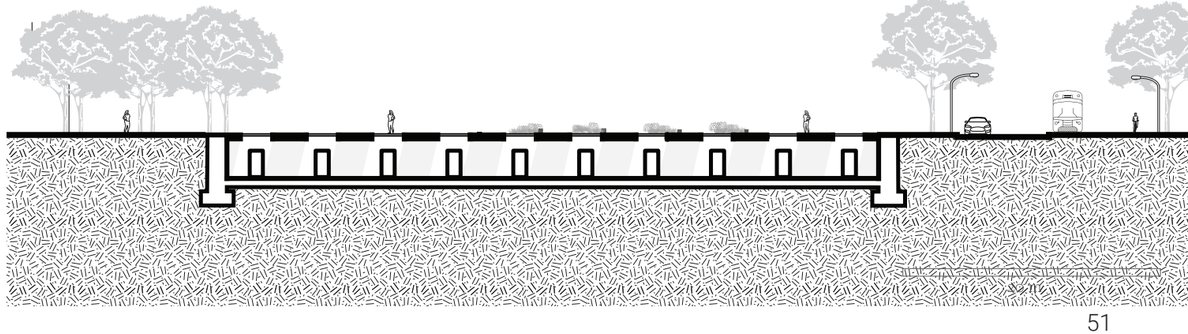
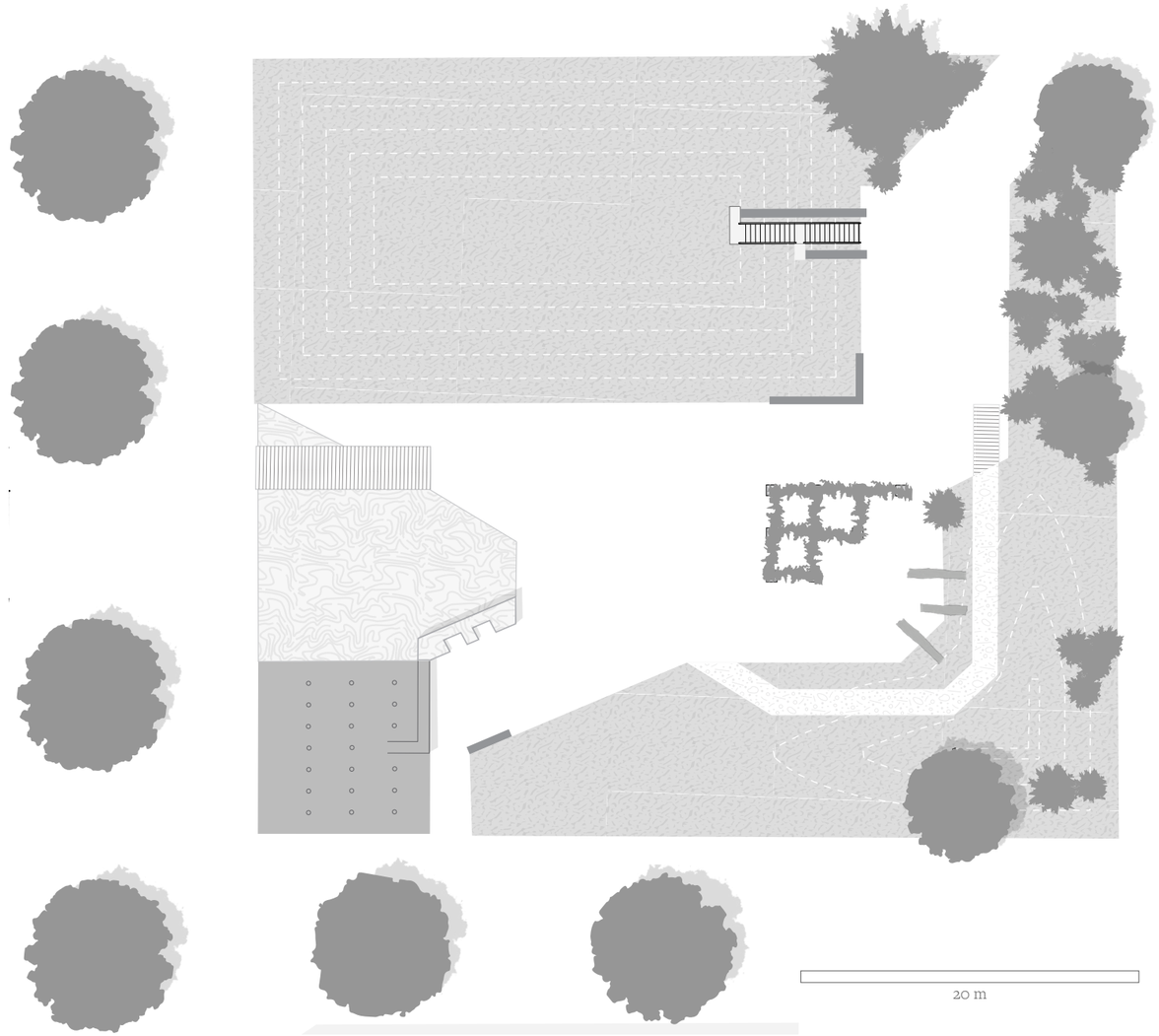


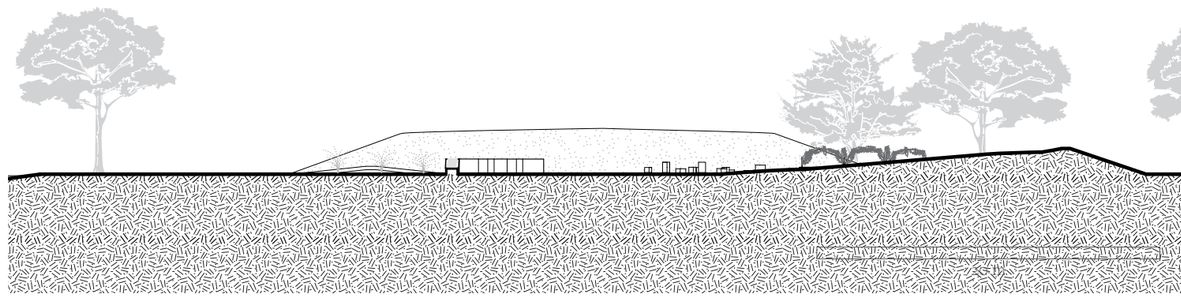
Fig 22. Plaza Perspective
Fig 23. Plaza Section (opposite)
Fig 24. Plaza Plan (opposite)

Across the road are the more private spaces: the pool, the play area, and the community garden and greenhouses. While there are still sensors located in these spaces, they are not as concentrated and collect almost no personally identifying data. The play area includes a sand area, and splash pad, a hill for toboganning in the winter, plants for nature play, slides, and blocks of different shapes and sizes for children to construct their own space.

Fig 25. Play Area Perspective

Fig 26. Play Area Winter





The play area and the community garden are guided by the grid, but begin to break it. The various elements of the play area define its rectilinear boundary. The interior of the space is open and less rigid, however, so children can define their own space with blocks and define play between the various elements. The play area is also fully accessible. The splash pad and the sandbox both have raised 'table' elements so children with mobility impairments can also interact with the water and the sand. Plants for nature play define the north-east corner of the space.

Fig 27. Play Area Plan (opposite)
Fig 28. Play Area Section (opposite)

The community garden and greenhouses would be available for the many new residents of the area to use. The greenhouses would allow for some plants to still be grown in the colder months, as well as for people to grow plants that are of cultural significance to them but not suited to Toronto's climate. The growing of each plant represents a new start, and people of all ages can participate in gardening. The waste heat from the server room will be used to heat the greenhouses.

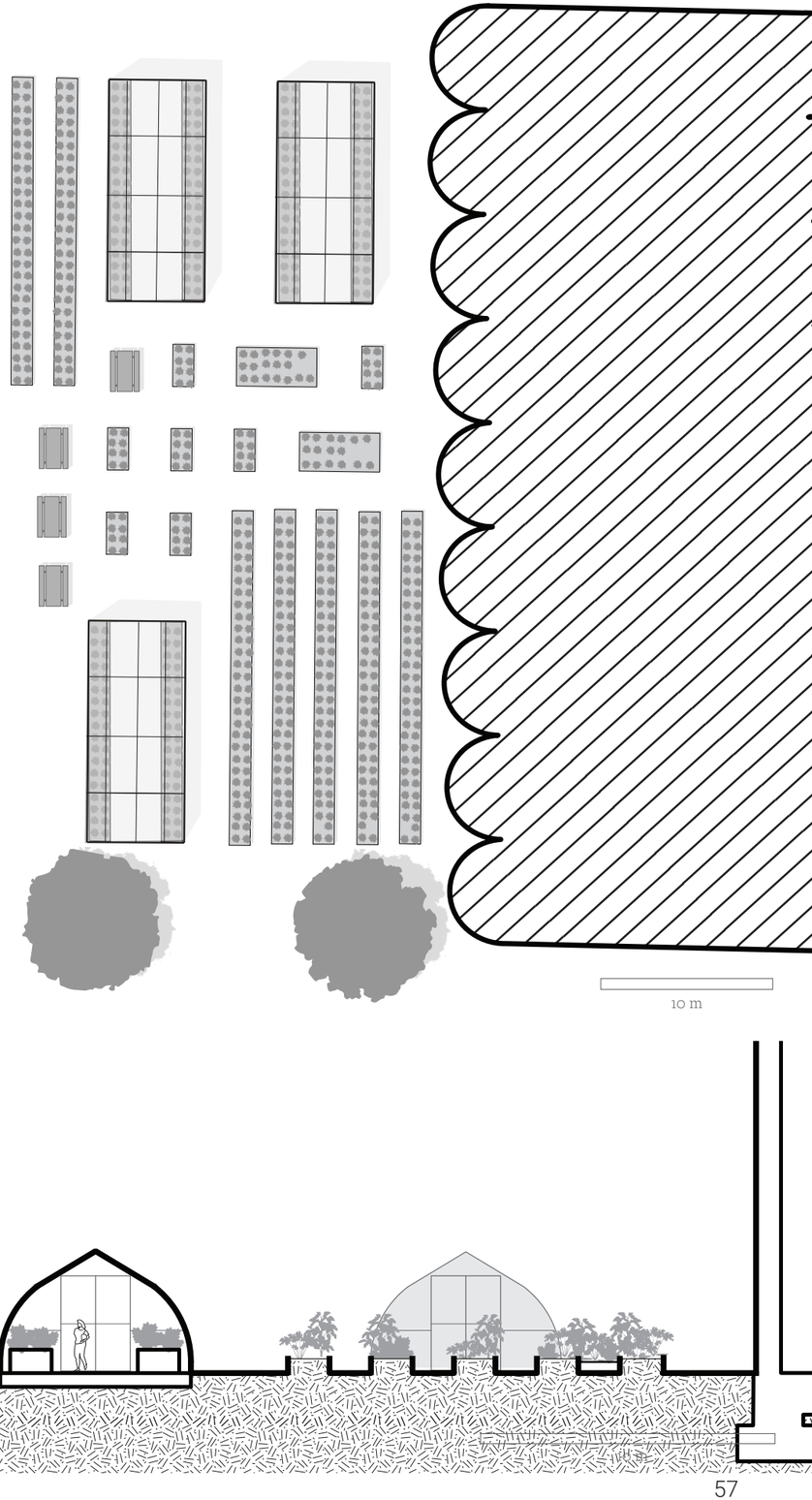


Fig 29. Community Garden Perspective
Fig 28.Garden Section (opposite)
Fig 30. Garden Plan (opposite)

The pool is the centrepiece of the site's programming. Public pools have historically functioned as social equalizers, as people of all ages and walks of life like to swim. There are not any outdoor pools in this area, or places one can swim outside, given the occasionally poor water quality of Lake Ontario. As well, there is a growing need for spaces one can cool down in the summer, as Toronto's summers get increasingly hotter. The pool is set down into the existing slip, and breaks free of the grid that was set up in the north. It is large to accommodate many people, gradually slopes down for easy access and also includes a separate lap pool. The hot tub will be available year round, and also heated with waste heat from the servers, as will the pool.

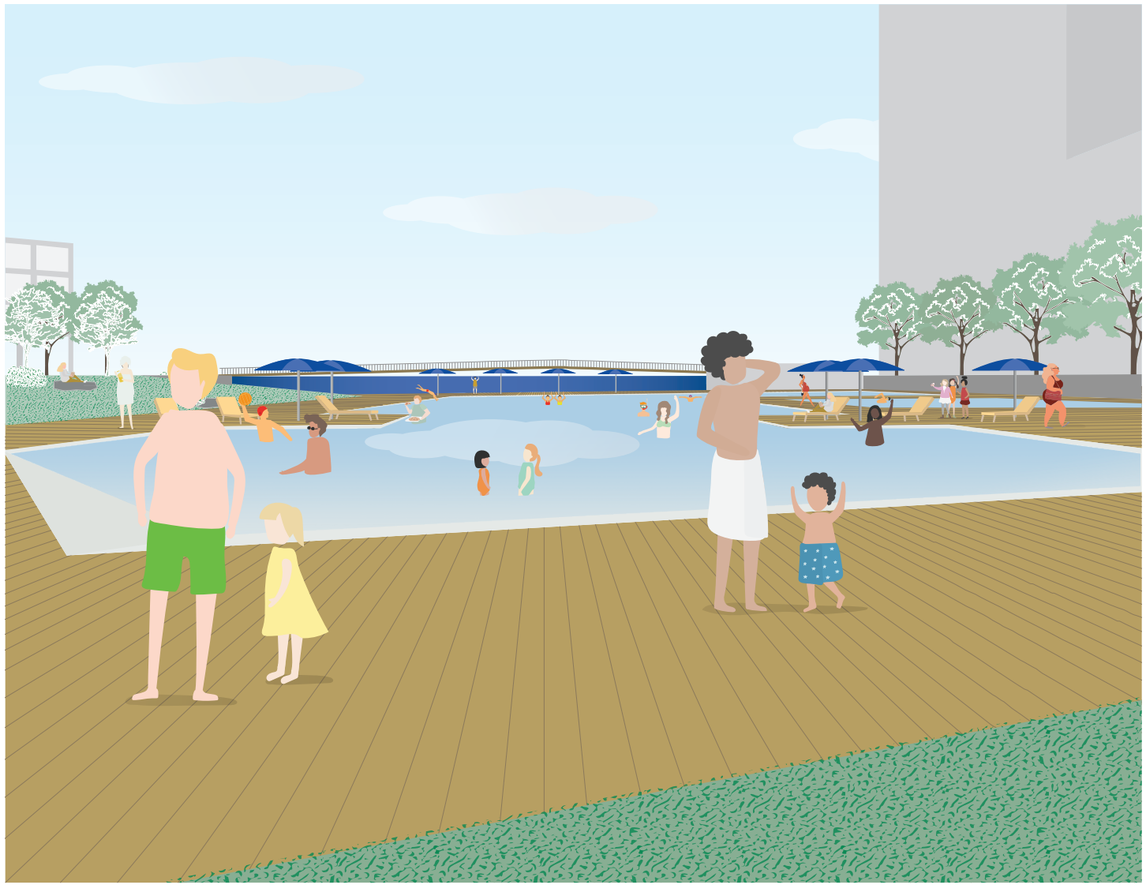
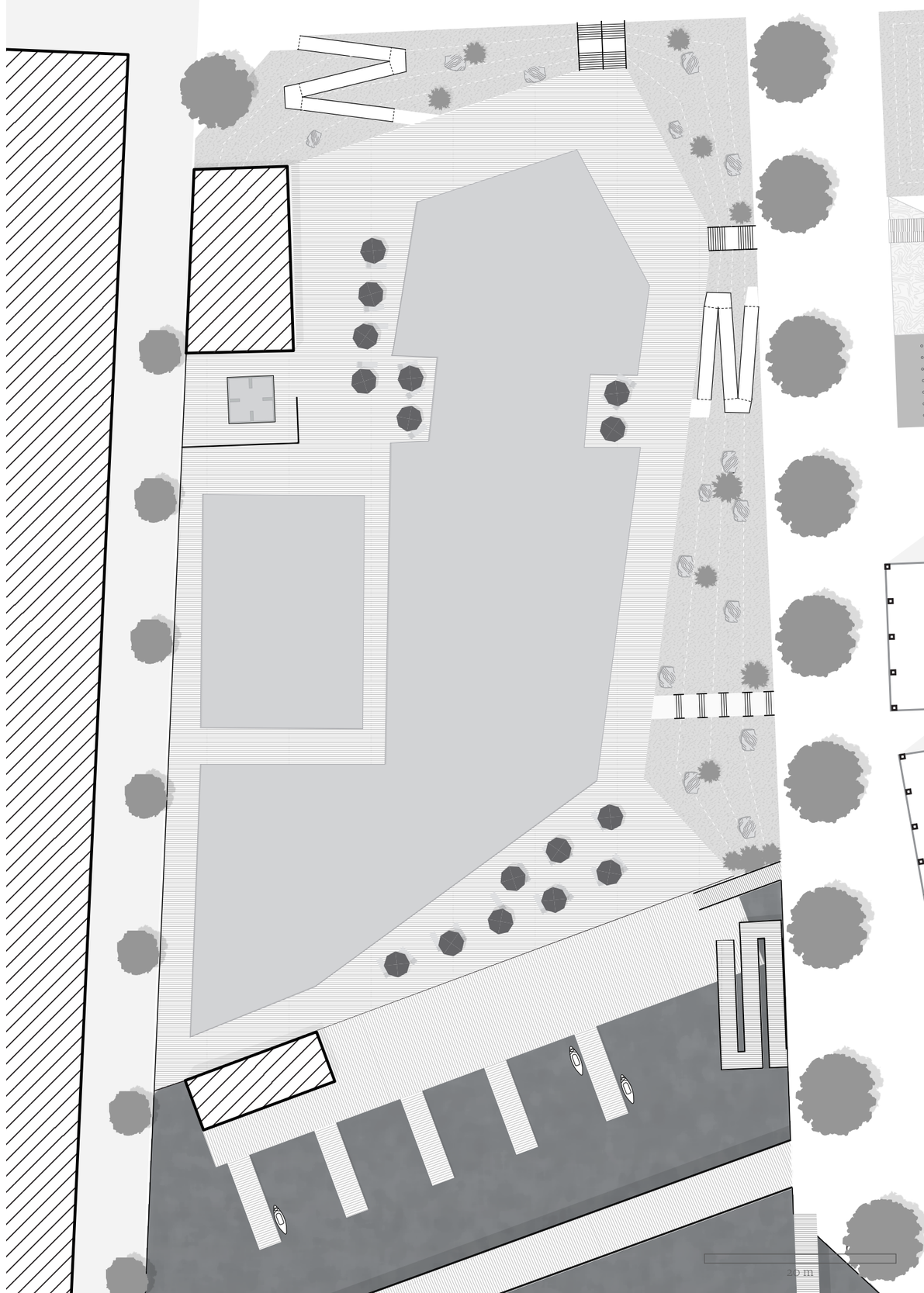


Fig 31. Pool Perspective

Fig 32. Hot Tub Perspective

Fig 33. Dock Perspective
Figure 34. Pool Plan (opposite)

The pool deck leads into the dock at the far south of the site. This is a launch point for non-motorized boating in the area, and has a building for storing canoes and kayaks. The docks here can also be used for sport fishing, which is growing in popularity in the area. In this area of the site, only environmental quality sensors are present and no personally identifying information is gathered.



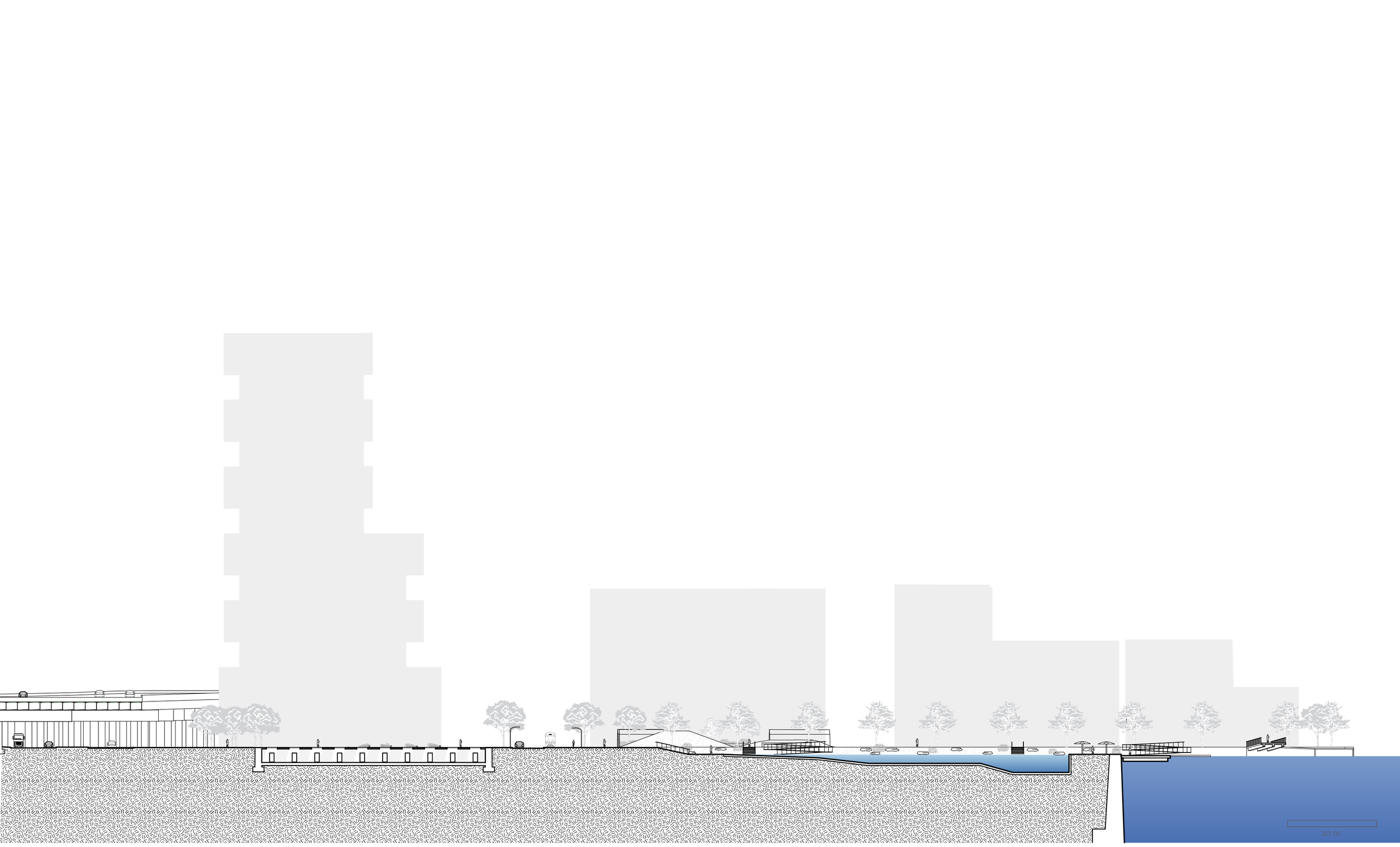


Fig 35. N-S Section

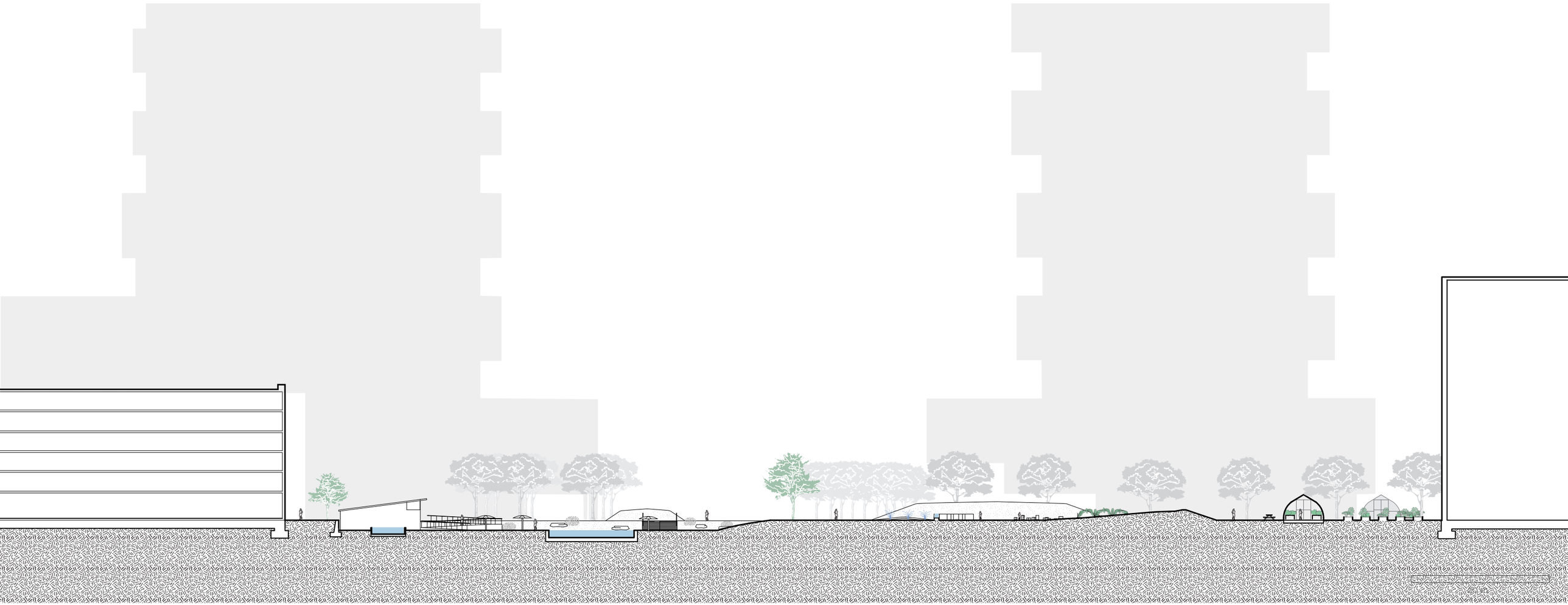


Fig 35. E-W Section

Conclusion

These physical programming of the space and the associated digital spaces create a gradient across the site, whereby citizen users have a choice in their experience of the space. There is a choice in digital experience, depending on one's wishes as to their level of privacy and engagement with Sidewalk Labs. There is a choice in physical experience through a suite of programming sensitive to the site: playing, gardening, swimming, boating, fishing. By deliberately programming the space to encourage community building separate from the digital and by controlling the extent and nature of the digital space, its possible to make the balance of power between citizens and these tech developers more equitable.

This design project is a template for considering the question of smart cities across the globe. All smart city developments will be different, depending on their location, cultural context, and head organization, whether private or public. While the specific programming and design of this site is contextual to Quayside, the four principles for the role of public space in smart cities are applicable to all: the performance of public identity, opportunities and alternatives for action, equality in communication and interaction, and grounds for worldly experience. Smart cities should foreground the human experience, and the digital infrastructure should merely support it. As Arendt wrote, humans are infinitely capable of improbable things, and the world would be nothing without it (1958, p. 178).

Works Cited

Allen, Danielle. (2018). Foreward. In Hannah Arendt, *The Human Condition* (p. ix-xvii). Chicago: The University of Chicago Press.

Arendt, Hannah. (1958). *The Human Condition*. (2nd ed.). Chicago: The University of Chicago Press.

Arup & RIBA. *Designing with data: Shaping our future cities*. Retrieved from https://www.architecture.com/-/media/gathercontent/designing-with-data/additional-documents/designingwithdatashapingourfuturecitiespdf.pdf

Balsillie, Jim. (2018, Oct 5). "Sidewalk Toronto has only beneficiary, and it is not Toronto." *The Globe and Mail.* Retrieved from https://www.theglobeandmail.com/opinion/article-sidewalk-toronto-is-not-a-smart-city/

Beardsley, John. (2007). Conflict and Erosion: The Contemporary Public Life of Large Parks. In Julia Czerniak & George Hargreaves (Eds.), *Large Parks*. New York City: Princeton Architectural Press.

Bliss, Laura. (2018, Jan 9). When a Tech Giant Plays Waterfront Developer. *CityLab*. Retrieved from https://www.citylab.com/design/2018/01/when-a-tech-giant-plays-waterfront-developer/549590/

Braham, William W. and Jonathan A. Hale. (2007). Introduction. In William W. Braham & Jonathan A. Hale (Eds.), *Rethinking Technology* (p. xii-xvi). New York City: Routledge.

Brenner, Neil. (2014). Neoliberalisation. In Fulcrum (Ed.), *Real Estates: Life Without Debt*. London: Bedford Press.

Brundidge, Jennifer and Ronald E. Rice. (2010.) Political Engagement Online: Do the information rich get richer and the like-minded more similar? In Andrew Chadwick & Philip N. Howard (Eds.), Routledge Handbook of Internet Politics (p. 144-156). New York, NY: Routledge.

Burgess, Matt. (2018, Feb 16). What is the Internet of Things? WIRED Explains. *Wired*. Retrieved from https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot

Bynum, W.F. (2013). On the mode of communication of cholera: W.F. Bynum reassesses the work of John Snow, the Victorian 'cholera cartographer'. *Nature, 495*(7440), p. 169+

Canovan, Margaret. (1988). Introduction. In Hannah Arendt, *The Human Condition* (p. xix-xxxii). Chicago: The University of Chicago Press.

Castells, Manuel. (2004). Space of Flows, Space of Places: Materials for a Theory of Urbanism in the Information Age. In William W. Braham & Jonathan A. Hale (Eds.), *Rethinking Technology* (p. 418-434). New York: Routledge.

Ceen, Allan. Nuova Pianta di Roma Data in Luce da Giambattista Nolli l'Anno MDCCXLVIII. *The Nolli Map and Cartography*. Retrieved from http://nolli.uoregon.edu/nuovaPianta.html

Columbus, Louis. (2018, Dec 13). 2018 Roundup Of Internet of Things Forecasts and Market Estimates. *Forbes*. Retrieved from https://www.forbes.com/sites/louiscolumbus/2018/12/13/2018-roundup-of-internet-of-things-forecasts-and-market-estimates/#dc6352b7d838

Corner, James. (1999). The Agency of Mapping: Speculation, Critique and Invention. In Denis Cosgrove (Ed.), *Mappings* (p. 213-252). London: Reaktion.

Donnelly, Grace. (2018, May 9). Amazon Alexa Will Come Built-in to All New Homes from Lennar. *Fortune*. Retrieved from http://fortune.com/2018/05/09/amazon-alexa-lennar/

Eidelman, Gabriel. (2016). Failure When Fragmented: Public Land Ownership and Waterfront Redevelopment in Chicago, Vancouver, and Toronto. *Urban Affairs Review, 54*(4), p. 697-731.

Fernandez-Galiano, Luis. (1982). Organisms and Mechanisms, Metaphors of Architecture: Mechanical, Thermal, and Cybernetic Machines versus the Living and the Built. In William W. Braham & Jonathan A. Hale (Eds.), *Rethinking Technology* (p. 256-257). New York: Routledge

Fussell, Sidney. (2018, Nov 21). The City of the Future is a Data-Collection Machine. *The Atlantic*. Retrieved from https://www.theatlantic.com/technology/archive/2018/11/google-sidewalk-labs/575551/

Galang, Jessica. (2018, Dec 5). Ontario Auditor General Highlights Several Concerns Regarding Waterfront Toronto's Handling of Quayside. *Betakit*. Retrieved from https://betakit.com/ontario-auditor-general-highlights-several-concerns-regarding-waterfront-torontos-handling-of-quayside/

Giguere, Joy. (2018). "Too Mean to Live, and Certainly in No Fit Condition to Die": Vandalism, Public Misbehaviour, and the Rural Cemetery Movement. *Journal of the Early Republic, 38*(2), p. 293-324

Gottesman, Alex. (2014.) *Politics and the Street in Democratic Athens.* Cambridge: Cambridge University Press.

Harcourt, Mike and Nola Kate Seymoar. (2017, Mar 4). Opinion: Canadian cities face complex problems in the urban century. *The Vancouver Sun*. Retrieved from https://vancouversun.com/opinion/opinion-canadian-cities-in-the-urban-century

Harvey, David. (1982). *The Limits to Capital*. Oxford: Basil Blackwell.

Hatuka, Tali, and Eran Toch. (2016). The emergence of portable private-personal territory: Smartphones, social conduct and public spaces. *Urban Studies, 53*(10), p. 2192-2208.

Hollands, Robert. (2008). Will the real smart city please stand up? *City, 12*(3), p. 303-320.

Hume, Christopher. (2017, July 3). A case for Waterfront Toronto's Port Lands: Hume. *The Toronto Star*. Retrieved from https://www.thestar.com/news/gta/2017/07/03/a-case-for-waterfront-torontos-port-lands-hume.html.

Illich, Ivan. (2005). *The rivers north of the future: the testament of Ivan Illich*. David Cayley (Ed.). Toronto: House of Anansi Press.

Illing, Sean. (2017, Mar 16). A political scientist explains how big data is transforming politics. *Vox*. Retrieved from https://www.vox.com/conversations/2017/3/16/14935336/big-data-politics-donald-trump-2016-elections-polarization.

Kitchin, Rob. (2014). *The Data Revolution: Big Data, Open Data, Data Infrastructures & Their Consequences*. London: Sage Publications.

Koolhaas, Rem. (1995). Whatever Happened to Urbanism? *Design Quarterly, 164*, p. 28-31.

Larson, Scott. (2018). Imagining social justice and the false promise of urban park design. *Environment and Planning A, 50*(2), p. 391-406.

Laurence, R., Esmonde Cleary, S., & Sears, G. (2011). Assembling the city 1: Forum and basilica. In *The City in the Roman West*, c.250 BC–c.AD 250 (170-202). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511975882.009

Lee, Susan. (2016, Sept 19). Welcome to Masdar City: the ultimate experiment in sustainable urban living. *The Conversation*. Retrieved from https://theconversation.com/welcome-to-masdar-city-the-ultimate-experiment-in-sustainable-urban-living-65575

Lystra, Margot. (2014). McHarg's Entropy, Halprin's Chance: Representations of Cybernetic Change in 1960s Landscape Architecture. *Studies in the History of Gardens & Designed Landscapes, 34*(1), p. 71-84.

May, John. (2017). Everything Is Already an Image. *Log 40*, p. 9-26.

McLuhan, Marshall. (1997). Understanding Media. In Eric McLuhan and Frank Zingrone (Eds.), *Essential McLuhan* (p. 149-179). London: Routledge.

Mitchell, William J. (2002). E-Bodies, E-Buildings, E-Cities. In William W. Braham & Jonathan A. Hale (Eds.), *Rethinking Technology* (p. 406-415). New York: Routledge.

Meyer, Elizabeth. (2007). Uncertain Parks: Disturbed Sites, Citizens, and Risk Society. In Julia Czerniak and George Hargreaves (Eds.), *Large Parks*. New York City: Princeton Architectural Press.

Moore, Jacob and Susanne Schindler. (2015). Defining Inequality. In Reinhold Martin, Jacob Moore & Susanne Schindler (Eds.), *The Art of Inequality: Architecture, Housing, and Real Estate* (p. 18-35). New York, NY: The Temple Hoyne Buell Center for the Study of American Architecture.

Németh, Jeremy. (2009). Defining a Public: The Management of Privately Owned Public Space. *Urban Studies, 46*(11), p. 2463-2490.

Offenhuber, Dietmar, and Carlo Ratti. (2014). Introduction. In Dietmar Offenhuber & Carlo Ratti (Eds.), *Decoding the City: How Big Data Can Change Urbanism* (p. 6-16). Basel: Birkauser.

Olmsted, Frederick Law. (1881). *A Consideration of The Justifying Value of a Public Park*. Boston: Tolman & White. Retrieved from https://archive.org/details/aconsiderationj000lmsg00g/page/n4

Parkinson, John. (2012). *Democracy & Public Space: The Physical Sites of Democratic Performance*. New York, NY: Oxford University Press.

Poon, Linda. (2018, Jun 22). Sleepy in Songdo, Korea's Smartest City. *CityLab*. Retrieved from https://www.citylab.com/life/2018/06/sleepy-in-songdo-koreas-smartest-city/561374/

Rainie, Lee and Kathryn Zickuhr. (2015). *Americans' View on Mobile Etiquette.* Retrieved from http://www.pewresearch.org/wp-content/uploads/sites/9/2015/08/2015-08-26_mobile-etiquette_FINAL.pdf.

Scassa, Teresa. (2018). *Data Ownership*. Waterloo, ON: Centre for International Governance Innovation.

Semuels, Alana. (2018, Aug 31). The Online Gig Economy's 'Race to the Bottom'. *The Atlantic*. Retrieved from https://www.theatlantic.com/technology/archive/2018/08/fiverr-online-gig-economy/569083/

Shelton, Taylor, Matthew Zook, and Alan Wiig. (2015). The 'actually existing smart city'. *Cambridge Journal of Regions, Economy and Society, 8*(1), p. 13-25.

Sidewalk Toronto. (2017). *Vision Sections of RFP Submission.* Retrieved from https://sidewalktoronto.ca/wp-content/uploads/2017/10/Sidewalk-Labs-Vision-Sections-of-RFP-Submission.pdf

Sidewalk Toronto. (2018, Nov 29). *Draft Quayside Site Plan.* Retrieved from https://sidewalktoronto.ca/wp-content/uploads/2018/11/18.11.29_Quayside_Draft_Site-Plan.pdf

Small, James & Glenn Miller. (2002). City Building in North America and Europe. In Jonathan Potter (Ed.), *Private Finance and Economic Development: City and Regional Investment* (p. 159-225). London: OECD.

Smith, Nicola. "Neoliberalism." Encylopaedia Britannica. Retrieved from https://www.britannica.com/topic/neoliberalism.

Stevens, Sara. (2016). *Developing Expertise: Architecture and Real Estate in Metropolitan America*. New Haven: Yale University Press.

Thuma, Andrea. (2011). Hannah Arendt, Agency, and the Public Space. In M. Behrensen, L. Lee & A.S. Tekelioglu (Eds.), *Modernities Revisited*, Vienna: IWM Junior Visiting Fellows' Coferences, vol. 29. Retrieved from http://www.iwm.at/publications/5-junior-visiting-fellows-conferences/vol-xxix/andrea-thuma-2/

Waldheim, Charles. (2006). Landscape as Urbanism. In Charles Waldheim (Ed.), *The Landscape Urbanism Reader* (p. 35-53). New York City: Princeton Architectural Press.

Webb, Alex. (2018, Aug 10). Google's Targeted Ads Are Coming to a Billboard Near You. *Bloomberg Opinion*. Retrieved from https://www.bloomberg.com/opinion/articles/2018-08-10/google-s-targeted-ads-are-coming-to-a-billboard-near-you

Whyte, William H. and Paco Underhill. (2012). *City: Rediscovering the Centre.* Philadelphia: University of Pennsylvania Press.

Wojcieszak, Magdalena E. and Diana C. Mutz. (2009). Online Groups and Political Discourse: Do Online Discussion Spaces Facilitate Exposure to Political Disagreement? *Journal of Communication, 59*, p. 40-56.

About. Retrieved from https://sidewalktoronto.ca/.

Breaking Down the Port Lands Flood Protection Project. Retrieved from https://portlandsto.ca/project-map/.

Construction. Retrieved from https://portlandsto.ca/construction/.

History of the Port Lands. Retrieved from https://portlandsto.ca/history-of-the-port-lands/.

(2014, June 5). *Port Lands Planning Framework: Land Use Direction*. Retrieved from https://www.toronto.ca/legdocs/mmis/2014/pg/bgrd/backgroundfile-70270.pdf

Project Timeline. The Port Lands. Retrieved from https://portlandsto.ca/project-timeline/

Section 3: Vision of the Port Lands Planning Framework. Retrieved from https://

portlandsto.ca/wp-content/uploads/Port+Lands+Planning+Framework_Section3.pdf

South Korea Conceptualizes the Ultimate Smart City. Retrieved from https://newcities.org/cityquest-songdo-south-korea-conceptualized-ultimate-smart-sustainable-city/

Speaker's Corner. Retrieved from https://www.royalparks.org.uk/parks/hyde-park/things-to-see-and-do/speakers-corner. Accessed 18/11/2018