Blurred Lines: Planning for Societal Change and Digital Disruption in the Built Environment

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Digital technology; Planning policy; Social value; Spatial planning

Abstract

In the UK, spatial planning first emerged in the 20th century as a mechanism for safeguarding people's health and well-being in the built environment. As physical conditions improved, the field naturally expanded to also consider wider social, economic, and environmental outcomes associated with building and land use. These uses are now being disrupted by digital technology, with new behaviours, tools, and services developing at an unprecedented rate. How should the built environment respond to these changes, and the opportunities and challenges they present? In this paper, I examine how the relationship between place, technology, and people has shaped our past, in order to better understand, and ultimately reposition, the role that the planning professions must take in shaping our future. I take a critical look at how digital technology is commonly framed in the context of "smart cities" and call for a new approach that puts the health and wellbeing of people and planet first.

Introduction

In recent decades, we have seen digital technology advancing more rapidly than any other innovation in human history.[1] While it took 6,000 years from the establishment of the first city for most of the world's population to become urban,[2] it took less than 60 years for the internet to turn 50% of the world's population into online users.[3] In 2022, there are five billion internet users worldwide,[4] and four out of five of the world's biggest companies by market capitalisation are providers of digital products, services, and infrastructure.[5]

Digital technology has also become a key subject of discussion in urban and regional planning. Since the "smart city" discourse was launched in the late 2000s, the market for smart urban technology has been on a trajectory of exponential growth, benefitting from favourable government initiatives and the steady arrival of new solutions.[6] In the UK, all the biggest cities and many of the smaller ones have set a smart city agenda in one form or another. The Royal Town Planning Institute (RTPI) has a *Digital Planning Manifesto*. The Royal Institution of Chartered Surveyors (RICS) has a *Data and Technology Action Agenda*. The 2020 Planning White Paper, *Planning for the Future*, expressed an ambition for the English

[1] "The Impact of Digital Technologies" United Nations, 2019 available at *www.un.org/en/un75/impact-digital-technologies*.

[2] The city of Uruk was established in southern Mesopotamia in the 4th millennia BC. It is recognised by many as the first city in the world. See, e.g. "Uruk: The First City" Met Museum, 2003 available at *www.metmuseum.org/toah/hd/uruk/hd_uruk.htm*. In 2009, the number of people living in urban areas surpassed the number of people living in rural areas for the first time. See, e.g. "Urban and Rural Areas 2009" United Nations (nd) available at *www.un.org/en/development/desa/population/publications/urbanization/urban-rural.asp*.

[3] The birthday of the internet (as a public resource) is recognised by many as 1983, when TCP/IP was introduced. Others cite the 1960s. See e.g. J. Jaffe, "Happy Birthday, Dear Internet" *Wired*, 31 December 2002 available at *www.wired.com/2002/12/happy-birthday-dear-internet/*. In 2018, half of the world's population was online. See e.g. E. White and O. Pinsky, "Half the world's population is still offline. Here's why that matters" *The World Economic Forum*, 14 May 2018 available at *www.weforum.org/agenda/2018/05/half-the-world-s-population-is-still-offline-heres-why-that-matters/*.

[4] "Global digital population as of April 2022" Statista Research Department, 26 July 2022 available at *www.statista.com/statistics/617136/digital-population-worldwide/*.

[5] The list is topped by Apple Inc, followed by Saudi Arabian Oil Co, Microsoft Corp, Alphabet Inc (Google) and Amazon.com Inc, M. Johnston, "Biggest Companies in the World by Market Cap" *Investopedia*, 9 August 2022 available at *www.investopedia.com/biggest-companies-in-the-world-by-market-cap-5212784*.

[6] Grand View Research, "Global Smart Cities Market Size, Share & Trends Analysis Report by Application, by Smart Governance, by Smart Utilities, by Smart Transportation, by Region, and Segment Forecasts, 2022–2030" (2022).

planning profession to "become an international world leader in digital planning, capable of exporting world class planning services around the world".[7] And in the recent Budget and Spending Review (2021) from HM Treasury, £65 million were allocated to "improve the planning regime, through a new digital system which will ensure more certainty and better outcomes for the environment, growth and quality of design".[8]

Despite such broad enthusiasm and significant investment, there is still no common definition of what a "smart city" is, nor how this concept might be delivered.[9] Stakeholders generally agree that technology is an opportunity to make our planning more "efficient, innovative, accessible, and responsive to environmental, social, and economic objectives", as stated in RTPI's manifesto,[10] or our cities more "efficient", "safe", and "sustainable", as promised by the big tech players.[11] And yet there are few concrete examples of where these visions have been realised. Except for a few extra gadgets, our homes, neighbourhoods, and cities still look very much like they did 50 years ago.

Digital technology pervades our lives; In the past minute, as you've been reading this, Google has facilitated 5.7 million searches and cleared revenue of US$433,014.[12] Today, adults in the UK will spend an average of four hours on the internet.[13] Our rapidly evolving relationship with the online world has created new shopping habits, work patterns, travel choices, business models, health regimes, and social behaviours. It has changed how we relate to each other, to ourselves, and to the world we inhabit. It is time the world responded by reshaping building and land uses to fit this reality and anticipate future needs.

In this paper, I examine the relationship between environment, technology, and society from a few different perspectives, in order to better understand, and ultimately reposition, how they interact in the context of urban planning. First, I look at the history of technology in relation to cities, societies, and the emergence of the spatial planning professions. Secondly, I take a critical look at how, why, and by whom digital technology has been framed as a tool for city-making in recent decades. And thirdly, I combine these findings to present a new approach to planning for societal change and digital disruption in the built environment.

Context

How is environmental, technological, and societal change connected?

The history of humankind is a fascinating tale of the interplay between environmental conditions, technological progress, and societal change. From the invention of stone tools by prehistoric nomads to the creation of computer networks by 20th century scientists, the milestones on our timeline sit squarely where these three elements (environment, technology, and society) coalesce.

[7] Ministry of Housing, Communities and Local Government, "Planning for the future: White Paper August 2020" (2020), p.71.

[8] M. Stride, L. Frazer and Great Britain Treasury, "Autumn Budget and Spending Review 2021: A Stronger Economy for the British People: Return to an Order of the House of Commons" (2021), p.107.

[9] S. Keshvardoost, D. S. Renukappa and D. S. Suresh, "Developments of policies related to smart cities: a critical review" (2018). IEEE/ACM International Conference on Utility and Cloud Computing Companion (UCC Companion). Also, Hollands (2008); Meijer & Rodriguez Bolívar (2016); Mora (2019) quoted in J. M. Barrutia, C. Echebarria, I. Aguado-Moralejo, V. Apaolaza-Ibáñez and P. Hartmann, "Leading smart city projects: Government dynamic capabilities and public value creation (2022) *Technological Forecasting and Social Change* 179 available at *https://doi.org/10.1016/j.techfore.2022.121679*.

[10] Royal Town Planning Institute, "A Digital Planning Manifesto" (2019) available at *www.rtpi.org.uk/policy/2019/september/a-digital-planning-manifesto/*.

[11] See e.g. Dell Technologies and Intel, "Smart Cities Increase Efficiency, Safety and Sustainability" CIO.com, 11 April 2022 available at *www.cio.com/article/308336/smart-cities-increase-efficiency-safety-and-sustainability.html*.

[12] A. Ali, "From Amazon to Zoom: This is what happens on the internet every minute" *The World Economic Forum*, 26 November 2021 available at *www.weforum.org/agenda/2021/11/amazon-youtube-zoom-internet-minute-2021/*.

[13] Ofcom, "Online Nation 2022 Report" (2022).

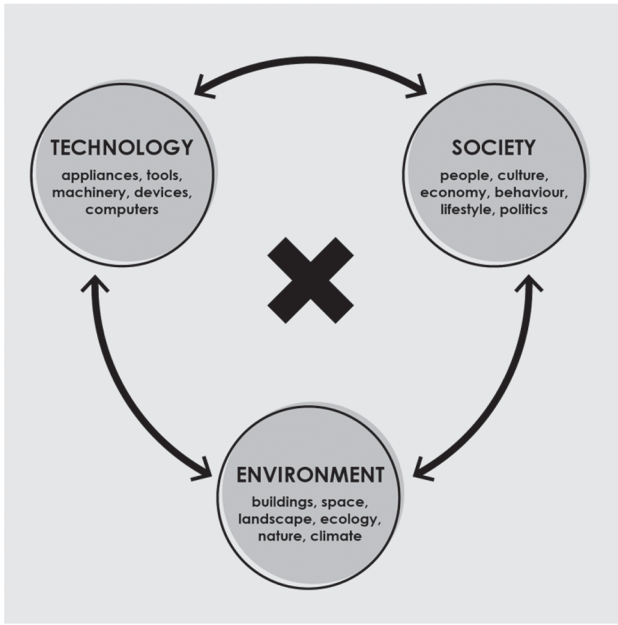

Figure 1: The key interrelated domains examined in this paper.

More than 100,000 years ago, clothing was a necessary technology for migrating north of Africa, into the colder regions of Europe and then beyond.[14] 12,000 years ago, coinciding with the end of the last ice age, the shift from nomadic to settled life propelled advances in agricultural and domestic technology, together with the emergence of more complex social structures and hierarchies.[15] The invention of the wheel and wheeled vehicles some 6,000 years ago, marks another great shift in work and life.[16] With the ability to lift, carry, and move heavier goods across longer distances, new patterns of trade and travel emerged and, with them, new hubs and networks of economic activity.[17] Just as the wheel may be considered a breakthrough in transportation technology, the invention of writing (also by ancient civilisations) has been identified as the first significant milestone in the development of information and communication tools.[18] In the following millennia, the world's first cities started to form around new urban technologies like paved road networks and irrigation systems. Larger societies led to divisions of labour, creating opportunities for knowledge specialisation and the organisation of competencies, and for the further development of status symbols and social order.[19]

Terminology. The word "technology" originates from Greek and can be directly translated as the systemic treatment (logos) of an art or craft (techne). The term rose to prominence throughout the

[14] University of Florida, "Lice DNA study shows humans first wore clothes 170,000 years ago" (2011) available at *www.sciencedaily.com/releases/2011/01/110106164616.htm*.

[15] E. Blakemore, "The Neolithic Revolution—facts and information" *National Geographic*, 5 April 2019 available at *www.nationalgeographic.com/culture/article/neolithic-agricultural-revolution*. O. Bar-Yosef, "From Sedentary Foragers to Village Hierarchies: The Emergence of Social Institutions" (2021) 110 *Proceedings of the British Academy* 1–38.

[16] M. N. Woessner, A. Tacey, A. Levinger-Limor, A. G. Parker, P. Levinger and I. Levinger, "The Evolution of Technology and Physical Inactivity: The Good, the Bad, and the Way Forward" (2021) *Frontiers in Public Health* 9 available at *https://doi.org/10.3389/fpubh.2021.655491*.

[17] M. Bondar, "Prehistoric innovations: Wheels and wheeled vehicles" (2018) 69(2) *Acta Archaeologica* 271–297 available at *https://doi.org/10.1556/072.2018.69.2.3*.

[18] A. M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (New York: W. W. Norton & Co, 2013).

[19] M. Kranzberg and M. T. Hannan, "History of the organization of work" *Encyclopedia Britannica*, 1 November 2021 available at *www.britannica.com/topic/history-of-work-organization-648000*.

20th century, with industrialisation leading to the specialisation of sectors, and the development of specific knowledge and skills required to under-take particular tasks.

The relationship between place (i.e. environment), technology, and people (i.e. society), continued to evolve through the Middle Ages. With the invention of the printing press around 1440, the precursor to modern information technology was born. In addition to catalysing improved literacy across Europe, printing activities in the late 1400s have also been linked to urban growth acceleration of up to 60%, by making cities more attractive as economic and cultural centres.[20] But the next truly seismic shift in the urban context came in the early 1700s when the world's first coal-fired steam engine saw the light of day.[21] The First Industrial Revolution brought steam power, water power, and mechanisation to lines of production, fabrication, and transportation. The Second Industrial Revolution soon followed with electrical power and new methods of mass production and construction. With work moving from fields to factories came the expansion of urban agglomerations, supported by new types of buildings (e.g. skyscrapers), infrastructures (e.g. railways), and governance mechanisms (e.g. labour unions). It was towards the end of this period that urban planning began to emerge in Europe as a technical and legal occupation.[22] In the UK, for example, the first planning legislation was enacted in 1909, motivated by the need to safeguard people's health and quality of life in an increasingly expansive and complex built environment.[23] "It should be our duty to improve the health of the people throughout the length and breadth of the land, not only in the counties but in the urban districts …". So said Sir Walter Foster in reference to the bill, in a debate at the House of Commons on 5 April 1909.[24]

The passing of the Housing and Town Planning Act in 1909 came just one year after Henry Ford introduced the Model T motorcar, marking the beginning of a new era of transportation technology. Struggling with polluted, noisy, and crowded environmental conditions in the city, the rising middle class soon fled to the suburbs, manifested by identikit houses and road infrastructure. Concurrently, the urban industries became increasingly knowledge-based, with factories relocating to the countryside and business districts taking over as the economic engines of cities. Where before the development of new neighbourhoods had been somewhat spatially limited by the locations of stations and railway lines, the car unlocked the opportunity for urban sprawl and the separation of work and life by a car-based commute.[25] In 1963, planner Colin Buchanan wrote a report entitled *Traffic in Towns* for the UK Ministry of Transport. In it, he assessed the scope of motor vehicles and warned against the "damage to the environment for living which is manifested in danger (especially for pedestrians), anxiety, noise, pollution, vibration, and visual intrusion on an extensive scale".[26] Similar to Sir Walter Foster's statement, Buchanan is concerned with the health of the environment and people, in light of changes brought on by technological progress. Buchanan also comments on the social and economic cost of car-centric planning, reflecting the broadening of the planning profession that also occurred through the 20th century.[27]

[20] J. E. Dittmar, "Information technology and economic change: The Impact oof the Printing Press" (2011) 126(3) *The Quarterly Journal of Economics* 1133–1172 available at *https://www.jstor.org/stable/23015698*.

[21] A. Cooper and F. Wilkinson, "Industrial Revolution and Technology" *National Geographic Society*, 2 June 2022 available at *https://education.nationalgeographic.org/resource/industrial-revolution-and-technology*.

[22] Reinhard Baumeister's 1876 publication *Stadt-Erweiterungen in technischer, baupolizeilicher, und wirtschaftlicher Beziehung* is generally recognised as one of the first examples of creating a scientific basis for urban design. See e.g. S. V. Ward, *Planning the Twentieth-Century City: The Advanced Capitalist World* (Wiley, 2002).

[23] The first planning legislation in the UK was entitled The Housing and Town Planning Act 1909. See e.g. H. Ellis, "The Rise and Fall of the 1947 Planning System" *Historic England* 1 September 2017 available at *https://historicengland.org.uk/whats-new/debate/recent/town-and-country-planning-act-70th-anniversary/rise-and-fall-of-1947-planning-system/#ref2*.

[24] Historic Hansard (1909) HC Deb 5 April 1909 Vol.3 cc733–98: "Second Reading of the Housing, Town Planning, Etc Bill" UK Parliament available at *http://hansard.millbanksystems.com/commons/1909/apr/05/housing-town-planning-etc-bill#S5CV0003P0_19090405_HOC_242*.

[25] J. English, "The Commuting Principle That Shaped Urban History" *Bloomberg City Lab*, 29 August 2019 available at *https://www.bloomberg.com/news/features/2019-08-29/the-commuting-principle-that-shaped-urban-history*.

[26] Quoted in C. Buchanan, "Traffic in Towns: An Assessment after Twenty Years" (1978) 9(2) *Built Environment* 93–98, 93.

[27] J. Pendlebury, B. Cullingworth, D. Webb, T. Hart, G. Vigar, T. Townshend, V. Nadin and S. Davoudi, *Town and Country Planning in the UK* (Oxford: Taylor & Francis, 2014).

From clothing to cars, this broad overview of pivotal moments in the history of environmental, technological, and societal change goes to highlight: (a) the inherent interconnectedness that exists between these factors (place, technology, and people); and (b) the increasingly important role of planning as a tool to manage the development of this relationship for the good of the public. Which brings us to consider the issues of our present-day, and the impacts of the digital revolution.

What is digital technology and where did it come from?

Just as the First and Second Industrial Revolutions were catalysed by advancements in energy and manufacturing technologies, and the modernist era by new transportation technology, the so named Third (begun in the 1950s) and Fourth (2010s) Industrial Revolutions are beholden to significant improvements in the field of *information and communication technology*.

> *Terminology*. The word "digital" is directly derived from the technology's reliance on just two digits: 0s and 1s.

Digital tools, systems, and devices first emerged in the public domain in the latter half of the 20th century, following the discovery that electronic circuits with two fixed values were (and still are) an excellent way of transmitting and reconstructing information. By compressing information into 0s and 1s, large amounts of data could suddenly be easily stored, processed, and analysed, rapidly accelerating the capabilities of knowledge-based industries. In 1958, American psychologist of management Harold J. Leavitt and business professor Thomas L. Whisler wrote in Harvard Business Review: "The new technology does not yet have a single established name. We shall call it information technology."[28] And so it became. Later on, in the 1970s, information contained in a digital format was transmitted between two separate computers in near real time for the first time. Another decade later, the Internet became the world's first publicly available distributed online network, capable of transmitting data between computers and electronic devices with no direct physical connection.[29] Thus, as digital information technology (IT) was increasingly used to facilitate exchanges of information (i.e. communication), the term "information communication technology" (ICT) was adopted.[30] Today, ICT tends to apply in more technical contexts, while "digital technology" is the term that we use to talk about the broad application of these technologies day-to-day.

How did digital technology change society?

Today, digital technology permeates our lives, bringing everything from distant friends to exotic goods within reach at the click of a button. We can work with colleagues on the other side of the world in real time, or study at a first-rate university without ever stepping a foot on campus. We can order food to be delivered straight to the door, all the while posting on social media about the sad state of our local high streets. In the early 1990s, the biggest companies in the world represented a mix of industries, from energy (General Electric) and oil and gas (ExxonMobile) to retail (Walmart), banking (HSBC), and technology (IBM). Today, that same list is dominated by digital technology conglomerates, such as Apple, Microsoft, Alphabet (Google's parent company), Amazon, and Meta (Facebook's parent company). These companies have all excelled at commodifying the exchange of data, in an ecosystem unconstrained by space and time. As of April 2022, there were 5 billion internet users worldwide, making up 63% of the global

[28] H. J. Leavitt and T. L. Whisler, "Management in the 1980's" (1958) *Harvard Business Review* available at *https://hbr.org/1958/11/management-in-the-1980s*.

[29] J. Ball, *The System: Who owns the internet, and how it owns us* (London: Bloomsbury Publishing, 2020).

[30] J. Pawlak, G. Circella, H. S. Mahmassani and P. L. Mokhtarian, "Information and Communication Technologies (ICT), Activity Decisions, and Travel Choices: 20 years into the Second Millennium and where do we go next?" In Standing Committee on Effects of Information and Communication Technologies (ICT) on Travel Choices (2020) (ADB20).

population.[31] Half of us are also social media users,[32] and a quarter of the world purchase goods and services online.[33] Compared to past technological advancements, the digital transformation of our economic and social activities has happened in the blink of an eye.

In addition to revolutionising our methods of information and communication exchange, digital technology is also rapidly expanding the capabilities of other crafts. Transportation, construction, and manufacturing technology have all benefited from advancements in ICT, with solutions like autonomous vehicles, building information modelling software (BIM), and 3D printing to show for it. The combined impact of digital technology thus expands beyond its own sector, creating ripple effects of innovation that altogether becomes the "digital transformation" of our world. Studies suggest that the recent implications of COVID-19 have only accelerated these trends.[34]

How did digital technology change the physical environment?

In urban planning, we have been playing with advanced information and communication technologies since the 1950s,[35] altogether with varying outcomes. Early attempts at creating computer models to simulate and optimise urban systems mostly resulted in more time-intensive and less effective decision-making processes, and none were widely adopted across the planning industries.[36]

In 1973, the practice was broadly condemned in the Journal of the American Institute of Planners in an article written by Douglas B. Lee, aptly titled "Requiem for Large-Scale Models". Lee wrote, "In general, none of the goals held out for large-scale models have been achieved, and there is little reason to expect anything different in the future", and went on to point out that for each objective offered as a reason for building a model, there was usually a better, cheaper, more useful way of achieving said objective.[37] It is unclear to what extent the failures of these early experiments influenced the (lack of) development of digital technology for urban planning in the ensuing decades, but by the early 2000s, when digital data processing, analytics, and modelling had become common tools for much of the private sector, cities were still largely planned and governed offline.[38] And then the idea of a smart city was proposed.

Between 2007–2009, the greatest financial crisis since the Great Depression in 1929 wiped more than $2 trillion from the global balance sheet.[39] This event revealed serious fractures in our economic and social systems, forcing both the public and private sector to reconsider the factors underpinning their bottom line. Around the same time, the amount of people living in urban areas surpassed 50% for the first time in human history. For IBM, this was arguably the perfect moment to launch a campaign around smart cities, promising to help cities run "more efficiently, save money and resources, and improve the quality of life for citizens".[40] Throughout the year, they ran nearly 100 Smarter Cities Forums around the world.

[31] J. Johnson, "Global digital population as of April 2022" *Statista*, 26 July 2022 available at *www.statista.com/statistics/617136/digital-population-worldwide/*.

[32] S. Kemp, "Digital 2022: Global Overview Report" *DataReportal*, 26 January 2022 available at *https://datareportal.com/reports/digital-2022-global-overview-report*.

[33] D. Coppola, "Number of digital buyers worldwide from 2014 to 2021" *Statista*, 13 October 2021 available at *www.statista.com/statistics/251666/number-of-digital-buyers-worldwide/*.

[34] L. LaBerge, C. O'Toole, J. Schneider and K. Smaje, "COVID-19 digital transformation & technology" *McKinsey*, 5 October 2020 available at *www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever*.

[35] C. Salter, "The smart city is a perpetually unrealized utopia" *MIT Technology Review*, 24 June 2022 available at *www.technologyreview.com/2022/06/24/1053969/smart-city-unrealized-utopia/*.

[36] A. M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (New York: W. W. Norton, 2013).

[37] D. B. Lee Jr, "Requiem for Large-Scale Models" (1973) 39(3) *Journal of the American Institute of Planners* 163–178 available at *https://doi.org/10.1080/01944367308977851*.

[38] According to the Connected Places Catapult "Over 450,000 planning applications—each rich with data-rich drawings, tables and analysis—are made each year in the UK, but in formats (usually PDF or even scans of paper documents) that are non-searchable or readable by computers". Connected Places Catapult, "Building a 21st Century Digital Planning System: A Quick Start Guide" (2019) available at *https://cp.catapult.org.uk/news/building-a-21st-century-digital-planning-system-a-quick-start-guide/*.

[39] R. Merle, "A guide to the financial crisis—10 years later" *Washington Post*, 10 September 2018 available at *https://www.washingtonpost.com/business/economy/a-guide-to-the-financial-crisis--10-years-later/2018/09/10/114b76ba-af10-11e8-a20b-5f4f84429666_story.html*.

[40] IBM (nd), "IBM builds a smart planet" available at *https://www.ibm.com/smarterplanet/us/en/*.

Other technology companies quickly followed suit. In the words of Anthony Townsend, author of *Smart Cities* (2013), the likes of IBM, Cisco, and Siemens had "crafted a seductive pitch", promising that the same technology that had enabled the creation of a global economy could also be used to address local problems.[41] "If only we let them reprogram our cities, they can make traffic a thing of the past. Let them replumb our infrastructure and they will efficiently convey water and power to our fingertips. Resource shortages and climate change don't have to mean cutting back. Smart cities can simply use technology to do more with less, and tame and green the chaos of booming cities."[42] Townsend wrote this in 2013, not entirely without scepticism. A year later, a paper examining IBM's smart city campaign found it to be "storytelling, aimed at making the company an 'obligatory passage point' in the implementation of urban technologies".[43]

Figure 2: Planning notice in 2022's "smart" London

That the smart city agenda would (re)emerge in a time of financial crisis (and later austerity), from companies whose business it is to develop and operate digital technology, is of course not without significance. For a cash-strapped and resource-drained public sector, this was exactly the kind of initiative that would generate excitement and, as it were, attract investment. More than 50 countries attended the first Smart City Expo World Congress in Barcelona in 2011, the same year that 24 cities, including Glasgow (Scotland), were named winners of the IBM Smarter Cities Challenge.

[41] A. M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (New York: W. W. Norton, 2013), Preface, xiii.
[42] A. M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (New York: W. W. Norton, 2013), Preface, xiii.
[43] O. Söderström, T. Paasche and F. Klauser, "Smart cities as corporate storytelling" (2014) 18(3) *City* 307–320 available at *https://doi.org/10.1080/13604813.2014.906716*.

Despite this initial enthusiasm, the traces of digital technology in today's cities, and the uses of ICT in the planning and running of urban systems, remain somewhat underwhelming. Globally, there is still "no consensus as to what a smart city is and what needs to be done in order to make a city smart".[44] New projects such as Songdo (South Korea), Masdar (UAE), and the unrealised Waterfront Toronto (Canada), once promised as the future hallmarks of smart urbanism, have all quietly faded into the background again, failing to attract residents, businesses, and, in the case of Waterfront Toronto, public support.

In 2016, when Dan Doctoroff, CEO of Google's Sidewalk Lab, was in the early stages of designing Waterfront Toronto, he wrote in an online blog:

> "… a combination of digital technologies—ubiquitous connectivity, social networks, sensing, machine learning and artificial intelligence, and new design and fabrication technologies—would help bring about a revolution in urban life. Their impact will be as profound as the steam engine, the electric grid, and the automobile, the three previous technological revolutions that have largely defined the modern city."[45]

It is a compelling statement, to be sure. And yet, as an advancement of *communication technology*, is it realistic to believe that digital tools might change the *physical* shape of our cities any more than writing or indeed the invention of the printing press did? And if we are to see profound changes, wouldn't they primarily be catalysed by new behaviours and needs (i.e. societal and economic change), followed by any digitally enabled advances we might see in other fields, such as construction, manufacturing, and transportation technology?

The fact of the matter is that, at least so far, digital technology has had a very limited impact on the physical environment and its spatial organisation—especially in comparison to the transformation of other aspects of our lives. In the next section, I present a few different reasons for why this might be.

Challenges

Last year, Shannon Mattern, Professor of Anthropology at The New School for Social Research, published a book entitled *A City Is Not a Computer* (2021).[46] As prosaic as this statement might seem, it is nevertheless a truth that bears repeating. For in as many ways as cities and computers differ, there are examples of people and organisations trying to shape the former to operate as the latter. Why can't we build a smart city using the same tools that made the rest of the digital economy so successful? The short answer is, because it doesn't fit. Paradoxically, understanding and acknowledging the fundamental differences that exist between the digital and physical domains—and how people interact with them—is also the first step to bringing them together. In this section, I list three of the core issues: variables, viability, and physics.

An issue of variables: Not everything that matters can be counted

In the context of cities, digital technology is often put forward as an opportunity to run more efficient systems, capable of autonomous decision-making or, at the very least, capable of providing evidence to guide decision-making. In practice, this process is facilitated by data and algorithms.

An algorithm is a set of instructions performed on a number of input values (data), resulting in a number of output values (also data). For example, if six people (input) are coming to the meeting on Monday, the algorithm can tell you that you need to put out six chairs (output), providing that your instructions have

[44] J. M. Barrutia, C. Echebarria, I. Aguado-Moralejo, V. Apaolaza-Ibáñez and P. Hartmann, "Leading smart city projects: Government dynamic capabilities and public value creation" (2022) *Technological Forecasting and Social Change* 179 available at *https://doi.org/10.1016/j.techfore.2022.121679*.

[45] D. L. Doctoroff, "Reimagining cities from the internet up. Sidewalk Talk" *Medium*, 30 November 2016 available at *https://medium.com/sidewalk-talk/reimagining-cities-from-the-internet-up-5923d6be63ba*.

[46] S. Mattern, *A City Is Not a Computer* (Princetown University Press, 2021).

specified that there should be one chair per person. Algorithms are extremely useful for solving problems like this, where the input data is well known, and the instructions can be clearly articulated. For humans, there is a limit to the amount of input we can process, and that is where digital technology comes in. Where our minds boggle, computers can transfer, store, and process vast amounts of information, running complex calculations in virtually no time, to produce an outcome as per our instructions. Everything in the digital world, from dating apps to artificial intelligence (AI), is a product of algorithms.[47] In the former example, the instruction is for the system to identify matching dating profiles. In the latter example, the instruction is for the algorithm to learn from its own output, in order to ultimately rewrite and improve itself.

Figure 3: How algorithms work—more or less.

Planning has been described by Pendlebury as "the process by which government resolves disputes about the use of land".[48] Weighing up competing demands, and the positive and negative effects of different land uses, planning in England seeks to ensure that "the right development happens in the right place at the right time, benefitting communities and the economy".[49] Theoretically, this is the kind of challenge that could be solved by an algorithm. Imagine a programme capable of determining what to build where and when, based on a complex evaluation of pros and cons, and with instructions to maximise social, economic, and environmental benefit. That is (roughly) what the early urban modellers tried (and failed) to achieve, and it is what today's programmers of smart cities hope to deliver. See, for example the vision set out for Britain's National Digital Twin Programme, which promises to unlock benefits across a spectrum that varies from transparent stakeholder engagement to waste reduction.[50] This approach is also part of a narrative of "digital universalism".

The problem with digital universalism is that, as efficient as computers and algorithms might be, they are still only capable of handling whatever data they are fed. With a limited number of discrete variables, this is not necessarily a problem. But in any situation where the input represents a *selection* of data from an unlimited (or indeterminate) pool of variables, or where data might not easily be represented in numerical terms, the use of algorithms in decision-making inevitably makes for deficient results. Consider, that we are essentially trying to represent an entire urban system by 0s and 1s.

In *Smart Cities* (2013), Townsend writes about the 1960s/70s government-led initiative to use computer modelling to improve the performance of New York City's firefighting system. According to Townsend, RAND Institute developed a model based on a single measure of performance: response time. "Despite the RAND analysts' own misgivings about the usefulness of response time, it was the easiest indicator to measure reliably, and was less variable and therefore simpler to model."[51] The result of the analysis was the closure of several fire departments, particularly in poorer neighbourhoods, to the ultimate detriment—not benefit—of fire safety. You might say that if the model had considered a more complex set of inputs (such as traffic, weather, street grid, etc), the outcome would have been more reliable. But this raises new

[47] L. Rainie and J. Anderson, "Code-Dependent: Pros and Cons of the Algorithm Age" Pew Research Center, 8 February 2017 available at *www.pewinternet.org/2017/02/08/code-dependent-pros-and-cons-of-the-algorithm-age*.

[48] J. Pendlebury, B. Cullingworth, D. Webb, T. Hart, G. Vigar, T. Townshend, V. Nadin, and S. Davoudi, *Town and Country Planning in the UK* (Oxford: Taylor & Francis, 2014), p.2.

[49] Department for Communities and Local Government, "Plain English guide to the Planning System" (2015), p.4.

[50] Available at *www.cdbb.cam.ac.uk/what-we-did/national-digital-twin-programme*.

[51] A. M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (New York: W. W. Norton & Co, 2013), p.80.

questions, such as: what is the minimum number of variables to consider in the context of a city? Who decides what the selection of variables should be? Is the variable reliable? And finally: How can this data, if sufficiently comprehensive and reliable, also be continuously and effectively sourced?

The fact of the matter is that, in order to be manageable, urban data models have to be based on theoretical assumptions and a limited, highly curated set of variables.[52] Research consistently finds problems with the notion that a city could be represented entirely by data (which would make a "digital twin"), questioning the inability of such models to incorporate socio-political parameters,[53] in addition to the sheer impracticality of creating live data feeds from every single asset and citizen. This leaves us with an imperfect equation, riddled with biased data and unknown factors. Where digital technology is an excellent tool for processing information in a finite, tractable environment, like a production line in a factory, it inevitably falls short when faced with the endless nuances that colour our cities and towns.

An issue of viability: Cities are not "products" and citizens are not "users"

The current smart city discourse has largely been set by a few global, private technology companies, with clear commercial objectives for rendering the city dependent on digital tools and data. Even in situations where more civic minded objectives exist, the experience of these companies is still principally rooted in the private sector, creating a practical gap in knowledge and ethos in the public sector. Where early thoughts on the use of ICT in cities presented visions of technology as an enabler of new social practices, today the prevailing concepts revolve around the idea that large-scale data extraction is a way to increase revenue streams (or cut costs)—as expressed by Chris Salter, professor of immersive arts at the Zurich University of the Arts, in a recent article for MIT Technology Review.[54]

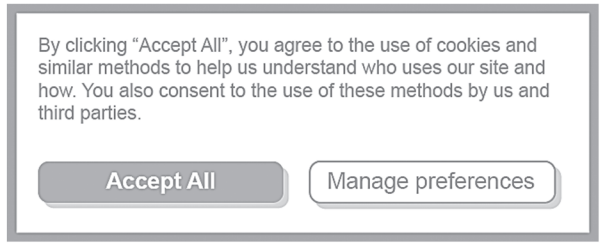

Figure 4: Imagine if the "site" in question was a physical space.

For a company or organisation with a clear product or message to sell, the value of data is clear; the more you know about your customer, the easier it is to target them; the more you know about your product, the easier it is to improve it; the more data you can collect, analyse, and use, the more powerful your algorithms for optimisation become. In a market-based economy, this gives providers of digital products, tools, and services an extraordinary competitive advantage; and it puts the owners of data platforms squarely on top of the power pyramid.

Whenever we interact with digital technology, we more or less knowingly enter into a data transaction agreement. In exchange for one kind of information, such as a YouTube video or a smart meter reading, we supply another kind of information, such as our cat video interests or energy usage patterns. To some extent, this information is used by the provider to improve our experience as customers and users. The next time you visit YouTube, there will be a selection of cat videos to choose from, just as your energy

[52] M. Charitonidou, "Urban scale digital twins in data-driven society: Challenging digital universalism in urban planning decision-making" (2022) *International Journal of Architectural Computing* available at *https://doi.org/10.1177/14780771211070005*.

[53] M. Charitonidou, "Urban scale digital twins in data-driven society: Challenging digital universalism in urban planning decision-making" (2022) *International Journal of Architectural Computing* available at *https://doi.org/10.1177/14780771211070005*.

[54] C. Salter, "The smart city is a perpetually unrealized utopia" *MIT Technology Review* 24 June 2022 available at *www.technologyreview.com/2022/06/24/1053969/smart-city-unrealized-utopia/*.

provider might be in touch with personalised energy-saving tips. However, the real value of this data is not realised by improving our user experience, but rather by mapping our customer potential. That is why the majority of Alphabet (YouTube, Google, Nest) and Meta's (Facebook, WhatsApp, Instagram) revenue is not from customer services but from ad sales.[55] By connecting more and more sources into centralised data platforms, these technology companies are on a mission to amplify their market intelligence, while excluding competition by enforcing proprietary standards of exchange.[56] At the core of it, their business is data, not services.

Any realisation of smart cities also relies heavily on data, or so we are told. In every smart city agenda, there is a point about the importance of data standards, storage, and processing. But data processing isn't free and, without a clear use case (i.e. business model), the cost of handling data quickly becomes quite uneconomical. In a report entitled "Demystifying the smart city", the organisation techUK soberly notes that "simply having and sharing data does not necessarily generate instant value".[57] Though solutions like city-scale Digital Twins promise to revolutionise the management of urban systems, research

also finds a "lack of clarity in terms of viable value propositions to facilitate and justify the required data collection, data sharing, and collaboration"[58] to enable this concept.

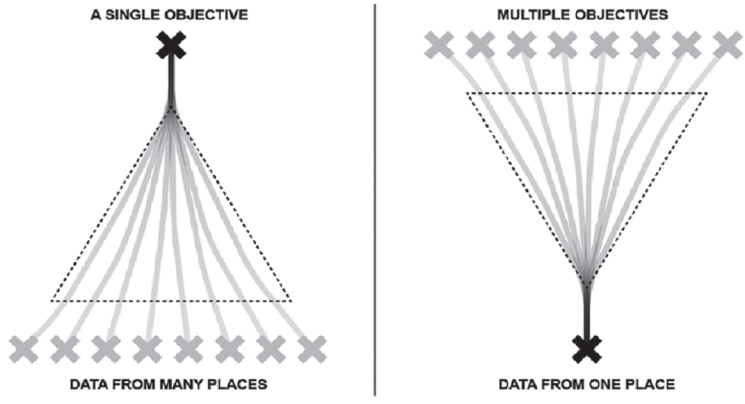

Figure 5. The data use case for a global private business can look very different from the use case of local authorities and developers. Technology companies can harvest data from billions of personal devices to drive simple objectives (usually revenue), while local authorities have both fewer sources to consult (limited public devices in a smaller area) and more complex outcomes to consider.

In addition to having very different viability challenges to private business, the collection and use of urban data also face a whole other level of privacy issues, especially in the liberal democracies operated by most of the Western World. When individuals engage with organisations, the terms and conditions of exchange are easy to define. In fact, most data protection law, such as the EU's GDPR, is focused on an individual's control over their personal information in a business-to-customer transaction. So, what

[55] M. Graham and S. Elias, "How Google's $150 billion advertising business works" CNBC, 18 May 2021 available at *www.cnbc.com/2021/05/18/how-does-google-make-money-advertising-business-breakdown-.html*.

[56] S. Barns, "Re-engineering the City: Platform Ecosystems and the Capture of Urban Big Data" (2020) *Frontiers in Sustainable Cities* 2 available at https://doi.org/10.3389/frsc.2020.00032.

[57] TechUK, "Demystifying the smart city—working towards better implementation" (2022).

[58] T. Nochta, L. Wan, J. M. Schooling and A. K. Parlikad, "A Socio-Technical Perspective on Urban Analytics: The Case of City-Scale Digital Twins" (2020) 28(1-2) *Journal of Urban Technology* 263–287 available at *https://doi.org/10.1080/10630732.2020.1798177*.

Figure 6: Data collection in public space (image by Michał Jakubowski).

happens when, in the words of Austin & Lie (2021), "Data becomes part of our public infrastructure rather than a feature of a particular transaction or relationship, unmoored from specific individuals and from specific projects and purposes, and created through complex private-public partnerships"?[59] This was arguably the biggest challenge that Google Sidewalk Labs' smart city project, Waterfront Toronto, encountered before it was shut down. The concept was premised on the ubiquitous distribution of sensors into streets and buildings, but neither the private company nor the public delivery vehicle had any authority to set a policy for how data collected from these devices could and should be used.[60]

This is potentially less of an issue in a more authoritarian regime, like China, where the national government has broad oversight of data collected from both public and personal devices, and the sovereignty to do with this data what it will.[61,62,63] But in a liberal, democratic context, the city cannot expect to extract data from users like a private corporation, because our civil rights are decidedly different from our user rights. It also cannot extract value from data like a private corporation, because there is no end product to sell; there is just the never-ending process of creating, distributing, and discarding resources to support work and life. These limitations should be seen as a good thing, reminding us that just as a city is not a computer, it is not a business either. Therefore, in order to assign a value to urban data, and be able to extract this value from our buildings and land, we need new models and rules developed specifically for a civic context, by the people who are experts and stakeholders in this field.

[59] L. M. Austin and D. Lie, "Data Trusts and the Governance of Smart Environments: Lessons from the Failure of Sidewalk Labs' Urban Data Trust" (2021) 19(2) *Surveillance & Society* 255–261.

[60] A. Flynn and M. Valverde, "Planning on the Waterfront: Setting the Agenda for Toronto's 'smart city' Project". (2019) 20(5) *Planning Theory & Practice* 767–775 available at *https://doi.org/10.1080/14649357.2019.1676566*.

[61] E. Pernot-Leplay, *China's Approach on Data Privacy Law: A Third Way Between the US and the EU?* (Shanghai Jiao Tong University, 2020).

[62] F. Yang and J. Xu, "Privacy concerns in China's smart city campaign: The deficit of China's Cybersecurity Law" (2018) 5(3) *Asia & The Pacific Policy Studies* 533–543 available at *https://doi.org/10.1002/app5.246*.

[63] J. Kynge, V. Hopkins, H. Warrell and K. Hille, "Exporting Chinese surveillance: the security risks of 'smart cities'" *Financial Times*, 9 June 2021 available at *www.ft.com/content/76fdac7c-7076-47a4-bcb0-7e75af0aadab*.

An issue of physics: There is no place without "space" and "time"

Before Facebook went public, founder Mark Zuckerberg famously set out in a letter to his investors that he would operate with a mentality to "move fast and break things".[64] This statement, though technically only an official Facebook motto until 2014, became endemic to many in the software development community.[65] With the ability to push upgrades with the push of a button, half-baked products could be shipped to market and evolve alongside user uptake. Being first was more important than being perfect. This mentality is reflective of two important aspects of digital technology. First, its instant malleability which gives it the ability to respond in real-time. Secondly, its power to scale unbound by physical constraints.

Figure 7: Even Google's Kings Cross campus is taking 4+ years to construct.

These are not natural attributes of the built environment, where both space and time play an instrumental part. Where the digital information and communication services sector is famous for disrupting the status quo, the building sector is notoriously one of the slowest in the adoption of innovation.[66] Mark Zuckerberg spent two weeks building the first version of Facebook,[67] and in 15 years, the platform had attracted over 2 billion users.[68] In comparison, it has taken almost 15 years to build London's Crossrail (not counting

[64] "Mark Zuckerberg's Letter to Investors: 'The Hacker Way'" *Wired*, 1 February 2021 available at *www.wired.com/2012/02/zuck-letter/*.

[65] G. Williams, "Silicon Valley's culture of breaking things is totally broken" *Wired*, 7 June 2018 available at *www.wired.co.uk/article/move-fast-and-break-things-or-dont*.

[66] E. Malakhatka, L. Sopjani and P. Lundqvist, "Co-Creating Service Concepts for the Built Environment Based on the End-User's Daily Activities Analysis: KTH Live-in-Lab Explorative Case Study" (2021) 13(4) *Sustainability* 1942 available at *https://doi.org/10.3390/su13041942*.

[67] B. Carson, "The True Story of How Mark Zuckerberg Founded Facebook" *Business Insider*, 28 February 2016 available at *www.businessinsider.com/the-true-story-of-how-mark-zuckerberg-founded-facebook-2016-2?r=US&IR=T*.

[68] F. Richter, "How Facebook grew from 0 to 2.3 billion users in 15 years" *The World Economic Forum*, 5 February 2019 available at *www.weforum.org/agenda/2019/02/how-facebook-grew-from-0-to-2-3-billion-users-in-15-years/*.

the planning stages), which will serve an estimated 0.2 billion passengers.[69] In 2012, when Crossrail had eight giant tunnel boring machines working "around the clock" to construct a single 42km tunnel, Facebook was shipping a new code twice a day.[70] How do you combine two worlds with such vast differences? It turns out, not without compromise.

Companies such as WeWork (office space), Airbnb (accommodation), Uber (transport), and Citymapper (transport planning), which are all operating in the physical world on the basis of digital business models, are simultaneously attracting significant investments and struggling to turn a profit. In 2017, Citymapper even pulled back from an attempt to expand its business into bus scheduling. As Taylor (2020) writes: "When they tried to move out of the virtual and into the physical, Citymapper realised that there's a lot more at stake when you're running physical assets".[71] With Waterfront Toronto, Google's Sidewalk Labs set out to, in the words of CEO Dan Doctoroff, "accelerate the process of urban innovation".[72] Yet Shannon Mattern (2021) reports that they were soon forced to slow down to allow for government bureaucracy and democratic deliberation.[73] What these examples go to show is that even the greatest technology giants become restricted by laws of physics when moving into the physical domain. It takes space, time, and energy to make a difference in the real world.

Sidewalk Labs were also hoping to use Waterfront Toronto as a testbed for developing gadgets and algorithms that could be scaled up and deployed in other projects and places. Not only did the public sector not insist on a share of the intellectual property rights for any such inventions,[74] one might also question what interest the local community would have had in serving as guinea pigs for a global business venture. Can you really safeguard local quality if the objective is toward global applicability? It is of course great if the experiences of one city can serve to inspire another, but that is quite different from giving a private corporation the exclusive rights to extract intel from an entire neighbourhood and its citizens. For a better example of what an urban innovation environment might look like, I refer to the KTH Live-In Lab in Stockholm (Sweden).

Because digital technology is ubiquitous, its ability to adapt and scale is virtually limitless, and that is also how it has been so successful at fuelling globalisation. In contrast, urban planning is the very art of managing the constraints of space over time, in order to deliver local outcomes. When digital technology is used as a tool to improve local conditions, Loukissas (2019) asks us to question to what extent it is truly those places that benefit, and to what extent those communities simply become less dependent on those places in which they live.[75] The built environment does not move fast, and when things break in the city, it can have serious social, economic, and environmental repercussions. That is why we have building regulations and planning laws, and stakeholder lists that are longer than Google's terms and conditions. Did we really think that we would be able to build a (democratic) smart city in less than a decade? Perhaps between "now" and "never", there is a compromise that combines the best of both worlds.

Opportunities

In the past decade, I have had the opportunity to work with technology companies and local governments in Denmark, the US, China, and the UK to interrogate how the digital, physical, and social domains could

[69] Crossrail, "Crossrail in numbers" (2018) available at *www.crossrail.co.uk/news/crossrail-in-numbers*.

[70] E. Protalinski, "Facebook now updates its code twice every day" CNET, 3 August 2012 available at *www.cnet.com/tech/services-and-software/facebook-now-updates-its-code-twice-every-day/*.

[71] M. Taylor, "How to save Citymapper" *Wired*, 26 May 2021 available at *www.wired.co.uk/article/how-save-citymapper*.

[72] D. L. Doctoroff, "Reimagining cities from the internet up. Sidewalk Talk" *Medium*, 30 November 2016 available at *https://medium.com/sidewalk-talk/reimagining-cities-from-the-internet-up-5923d6be63ba*.

[73] S. Mattern, "Why high-profile smart cities fail, from Sidewalk's Quayside to Amazon's HQ2 in Queens" *Fast Company*, 8 October 2021 available at *www.fastcompany.com/90664283/why-high-profile-smart-cities-fail-from-sidewalks-quayside-to-amazons-hq2-in-queens*.

[74] A. Flynn and M. Valverde, "Planning on the Waterfront: Setting the Agenda for Toronto's 'smart city' Project" (2019) 20(5) *Planning Theory & Practice* 767–775 available at *https://doi.org/10.1080/14649357.2019.1676566*.

[75] Commenting on the "One Laptop per Child" project. Y. A. Loukissas, *All Data Are Local: Thinking Critically in a Data-Driven Society* (The MIT Press, 2019), Introduction p.9.

and should be combined. Through these experiences, I have seen a lot of great ideas emerge, and been fortunate to meet many passionate people motivated by a genuine desire to make the world a better place. I have also come to believe that the problem is not a lack of prospects, but a lack of perspective. By allowing one sector to dominate the discourse, we have inevitably come to ask what the city can do for digital technology, instead of what technology can do for the city and, even more so, what the city can do for a digitally transformed society.

When planning legislation emerged in the UK in the early 20th century, it was a mechanism for safeguarding public health and wellbeing in an increasingly complex built environment. As the physical conditions of our neighbourhoods were generally improved, the field expanded to consider the overlaps with social, economic, and environmental planning too.[76] Now, as digital technology is catalysing major societal change in the form of new behaviours and services that further change our use of buildings, places, and resources, shouldn't this be a matter for the planning professions too?

Looking ahead, we should absolutely embrace digital tools and services in the planning profession, as already set out by the UK's Ministry of Housing Communities and Local Government (renamed the Department for Levelling Up, Housing and Communities), and many others. But this is just one aspect of preparing the built environment for the digital transformation that lies ahead. In this section, I reflect on three core opportunities—for communicating, evaluating, and imagining—and their limitations.

Digital technology as a communication tool: When the exchange of information requires speed and scale

A public consultation process is largerly about information sharing and communication, so it makes sense that ICT would be a useful technology to adopt for this purpose. In the guidance for neighbourhood planning, prepared by Locality for the Department for Levelling Up, Housing and Communities, communities are advised to make full use of digital and social media, as "social media is an effective means to disseminating information, encouraging dialogue and targeting different audiences".[77] Last year, DLUHC also launched a *PropTech Engagement Fund* to support innovation in digital engagement tools in the planning process. This year, more than £3 million have been awarded to 28 projects across England.[78]

However, research has found that even when making excellent use of ICT to encourage participation, communication between government agencies and citizens is still often primarily unidirectional for informing and education.[79] Another study, looking at 143 Spanish municipalities, found that too much effort on collaborating with citizens was often unproductive when not accompanied with "outstanding internal management capabilities".[80] In an England-based research project, Wilson (2019) concluded:

> "The findings demonstrate how technologies can facilitate discussion that is planning-related but identify a difficulty in turning this discussion into actionable policies … technologies must also be developed which provide actionable intelligence that can be translated into change."[81]

[76] J. Pendlebury, B. Cullingworth, D. Webb, T. Hart, G. Vigar, T. Townshend, V. Nadin and S. Davoudi, *Town and Country Planning in the UK* (Oxford: Taylor & Francis, 2014).

[77] D. Chetwyn, *Neighbourhood Plans Roadmap: A Step-by-Step Guide 2018 edition* (Locality & Ministry of Housing, Communities & Local Government, 2018), Pt C p.18.

[78] Department for Levelling Up, Housing and Communities, "New digital tools to help residents have their say on local developments" (2022) available at *www.gov.uk/government/news/new-digital-tools-to-help-residents-have-their-say-on-local-developments*.

[79] T. Choi and S. Meyers Chandler, "Knowledge vacuum: An organizational learning dynamic of how e-government innovations fail" (2020) 37(1) *Government Information Quarterly* available at *https://doi.org/10.1016/j.giq.2019.101416*.

[80] J. M. Barrutia, C. Echebarria, I. Aguado-Moralejo, V. Apaolaza-Ibáñez and P. Hartmann, "Leading smart city projects: Government dynamic capabilities and public value creation (2022) *Technological Forecasting and Social Change* 179 available at *https://doi.org/10.1016/j.techfore.2022.121679*.

[81] A. Wilson, M. Tewdwr-Jones and R. Comer, "Urban planning, public participation and digital technology: app development as a method of generating citizen involvement in local planning processes" (2019) 46(2) *Environment and Planning B: Urban Analytics and City Science* 286–302 available at *https://doi.org/10.1177/2399808317712515*.

Wilson also finds that there is appetite from communities to be involved in the planning process continuously, and not just in association with specific projects.

As we proceed to digitalise the planning process, it is important to remember these lessons, to do justice to communities by facilitating honest, worthwhile conversations. In the digital world, quantity may win out over quality, but in real neighbourhoods, quality always wins.

Figure 8: 25 Questions for Cities polling station.

Furthermore, I would point to the general lack of engagement with communities around how they wish to be engaged, particularly in relation to digital technology. In 2019, I led a project entitled "25 Questions for Cities", consisting of 25 binary options for how technology should be integrated into our cities (because digital communication is binary). The questions were presented as a collection of voting stations shaped as traffic cones, positioned in a public square. Passers-by were invited to consider the options—for example, whether algorithms should be trusted more than planning councils to issue permits or vice versa—before changing that status of the cone to reflect their response. The project revealed three important issues. First, the public generally has very little experience discussing the use of technology in the public space. Secondly, for many of the choices before us, there is no clear consensus. And thirdly, when invited to engage on digital matters in a real public space, fascinating in-person conversations almost always ensue.

Digital technology as an evaluation tool: When you can measure what you value.

Planning is a matter of evaluating competing demands for the use of land, so the ability to use digital technology to analyse large amounts of information is an obvious advantage. According to the *Planning for the Future White Paper*, the transition from documents to data will help increase the speed and quality of decision-making in the planning system.[82] In a blog written at the height of the COVID-19 pandemic,

[82] Ministry of Housing, Communities and Local Government, "Planning for the future: White Paper August 2020". (2020).

the UK's innovation accelerator for cities, transport & place leadership, Connected Places Catapult, further highlighted the role of advanced data modelling in a time of crisis:

> "The pandemic has reinforced the importance of sophisticated modelling capabilities and data-driven insights to help decision-makers make unprecedented decisions at speed."[83]

While there are undoubtedly great benefits to digitalising a range of decision-making tools, history warns us to approach this experiment with great caution. For even if it is somewhat true that we cannot improve what we do not measure (a sentiment commonly attributed to the management consultant Peter Drucker), it is also true that we often cannot measure what we care about and instead end up caring about what we have measured (a sentiment commonly attributed to the mathematician Richard Tapia). Another management consultant, W. Edward Deming, went so far as to say (paraphrased):

> "If management sets quantitative targets and makes people's job depend on meeting them, they will likely meet the targets—even if they have to destroy the enterprise to do it."[84]

Traffic planning is an obvious example of this phenomenon at play. In 1965, highway engineers in the US wrote the Highway Capacity Manual and coined the term "level of service" (LOS). The concept of the system was simple: by evaluating factors such as speed, travel time, interruptions, manoeuvrability, and operating cost, investments in road infrastructure could be adequately prioritised. In reality, this approach only made traffic worse. Between 1980 and 2014, major urban road mileage rose by 77% compared to a 41% growth in the population.[85] Furthermore, entire neighbourhoods were razed to the ground to make space for more highways and parking. What happened was a product of "induced demand"; when you make something easy and convenient to use, it will attract more users.

Conversely, during the same period of time, the City of Copenhagen was counting people and pedestrians in public spaces. In a collaboration between Professor Jan Gehl, from the Royal Danish Academy of Arts School of Architecture, and Copenhagen Municipality, the city's public spaces were evaluated based on the state of public life. This spurred a series of interventions to redirect space away from cars and towards the pedestrianisation of the city centre. Today, the Municipality is still looking at measures such as how much time people spend outside of the city to determine future planning decisions. Copenhagen has also, incidentally, been awarded as the most liveable city in the world.[86]

When I was an architect with Gehl, an urban quality consultancy co-founded by Jan Gehl, I was involved in a project to translate the practice's public life study methodologies into digital terms. In a collaboration between Gehl Institute, the Municipality of Copenhagen, the San Francisco Planning Department, and the Seattle Department of Transportation, the project created a data standard to enable the large-scale collection, processing, and sharing of public life performance indicators. The Public Life Data Protocol is now a publicly available resource that has been used in the creation of evaluation apps and to facilitate benchmarking between different authorities.

It is still infinitely easier to count cars than public life, and there is still much more data on vehicular movements than social encounters. In order to get a detailed, digitally recorded, understanding of how people use a city, we need sophisticated tracking technology which, once again, runs the risk of compromising our citizen rights. Last year, the Dutch City of Enschede was fined €600,000 by the Dutch Data Protection Authority (DPA) for "its use of Wi-Fi sensors to measure the number of people in the

[83] Connected Places Catapult, "Innovation Brief: Post-Pandemic Decision-Making and Institutions" (2020) available at *https://cp.catapult.org.uk/news/innovation-brief-post-pandemic-decision-making-and-institutions/*.

[84] The W. Edward Deming Institute, "Eliminate Slogans, Exhortations and Targets" (2016) available at *https://deming.org/eliminate-slogans-exhortations-and-targets/*.

[85] L. Fishbane, J. W. Kane and A. Tomer, "Stop trying to solve traffic and start building great places" *Brookings The Avenue*, 20 March 2019 available at *www.brookings.edu/blog/the-avenue/2019/03/20/stop-trying-to-solve-traffic-and-start-building-great-places/*.

[86] J. Andersen, "Copenhagen rated 'world's most liveable city'… Again" Copenhagen Science City, 4 July 2022.

city centre".[87] When creating tools for evaluation in planning, it is therefore important that we challenge both the suitability and availability of the data upon which our models will come to rely. It has also been documented that big data ecosystems increasingly function in ways that actively produce and even accelerate particular urban behaviours and interactions.[88] This further raises the bar for the quality of urban metrics and modelling.

Figure 9: Traffic monitoring in New York City

Finally, it is worth considering to what extent advanced urban modelling tools are being used to supplant the need for true leadership. Loukissas (2019) finds: "We have come to rely on the availability of data as generic resources of reasoning not only in scholarship but in education, politics, industry, and even our personal lives".[89] This statement echoes sentiments shared by Schumacher in the 1973 icon *Small is Beautiful*:

> "There is no need to consult economic experts when the question is of priorities … It is due to the fact that, as a society, we have no firm basis of belief in any meta-economic values, and when there is no such belief, the economic calculus takes over. This is quite inevitable. How could it be otherwise?"[90]

Similarly, one might do well to remember that there is also no need to consult (or pretend to consult) data experts when the question is one of priorities. We already have both the data and the technology we need to build more equitable and sustainable cities—the fact that we are not doing this, is not the computer's fault, nor its problem to solve.

Digital technology as a planning tool: When technology is the answer but not the question

Perhaps the greatest unrealised potential that digital technology presents is as a planning tool, or rather as an enabler of new planning paradigms. How should the built environment be developed for a fully

[87] S. Wray, "Dutch city hit with €600,000 GDPR fine over Wi-Fi counters" *Cities Today* 12 May 2021 available at *https://cities-today.com/dutch-city-hit-with-e600000-gdpr-fine-over-wi-fi-counters/*.

[88] S. Barns, "Re-engineering the City: Platform Ecosystems and the Capture of Urban Big Data" (2020) *Frontiers in Sustainable Cities* 2 available at *https://doi.org/10.3389/frsc.2020.00032*.

[89] Y. A. Loukissas, *All Data Are Local: Thinking Critically in a Data-Driven Society* (The MIT Press, 2019), Introduction p.2.

[90] E. F. Schumacher, *Small is Beautiful*, 2011 edn (Vintage, 1973), p.93.

digitally enabled society, and how can such a thing be done to benefit the natural environment too? This should be the prevailing question on the planning authorities' agenda.

Figure 10: Digital technology might make cars smarter, but the spatial challenges that cars present prevail.

In the past decade, it has been interesting to follow the visions presented by different parts of industry, all with an objective, in one way or another, to safeguard their own businesses for the future. The car industry has, for example, adopted advanced communication technologies to make their own (transportation) technologies smarter and, plainly speaking, continuously relevant. Now autonomous vehicles have been put forward as a solution to improve traffic and road safety, two problems which the industry has, by and large, itself created, and cities are being advised to prepare future street systems to enable this technology. In a *New York Times* article from 2019, an automotive industry official suggests installing gates at street corners, so the autonomous vehicle can cross at a green light without concern for jaywalkers.[91] Of course, there is a different version of this future, where a digitally enabled transportation system increases the opportunities for vehicle sharing, and for the multiplication of vehicle options (think electric bikes, scooters, personal carriers, minibuses, etc), thus reducing the demands on our roads altogether. With more people supported to work from home, or close to home, the pressure on our roads during peak hours should also ease, creating different pressures on local infrastructures to facilitate, e.g. lunchtime walks and remote co-working. What might this future look like?

New behaviours create new spatial requirements and technological needs, and in our shaping of new environments and technologies, we are in turn shaping new behaviours. Writing about Google Sidewalk Labs' Toronto project, Bianca Wylie observes that: "From its inception, the project failed to appreciate the extent to which cities remain strongholds of democracy and democratic process".[92] Wylie's article does not mention the many ways in which digital technology has also worked to undermine democracy in recent years,[93] but it could be argued that the role of city-making as a tool to bring people together in civic participation is only made all the more important, the more time people spend online. Just as the planners of the early 1900s asked if it was healthy for people to live in overcrowded tenements next to polluting factories, the planners of today could also ask if it is healthy for people to live in online echo chambers far from any real place of cultural meaning.

"Smart Kalasamata" is a new brownfield development in Helsinki, which will house approximately 25,000 residents and provide jobs for 10,000 people by 2035. The vision for this ambitious project, which was developed together with the public, is simply for everyone to gain an extra hour of free time every day.[94] What is truly smart about Kalasamata's approach is that it could technically be realised without the use of any technology at all. And this ultimately gives the City of Helsinki, the public sector developer of Kalasamata, and the citizens, the power of choice. When I was working with Dan Hill in Arup's Digital Studio, every presentation we ever put together would include a quote by Cedric Price from 1966: "Technology is the answer, but what was the question?" With this in mind, "How do we give citizens an

[91] E. A. Taub, "How Jaywalking Could Jam Up the Era of Self-Driving Cars" *The New York Times*, 1 August 2019 available at *www.nytimes.com /2019/08/01/business/self-driving-cars-jaywalking.html*.

[92] B. Wylie, "In Toronto, Google's Attempt to Privatize Government Fails—For Now" *Boston Review*, 13 May 2020 available at *https://bostonreview .net/articles/bianca-wylie-sidewalk-labs-toronto/*.

[93] The most well-known example is perhaps the Cambridge Analytica/Facebook scandal in 2018. J. Hinds, E. J. Williams and A. N. Joinson, "'It wouldn't happen to me': Privacy concerns and perspectives following the Cambridge Analytica scandal" (2020) *International Journal of Human-Computer Studies* 143:102498 available at *https://doi.org/10.1016/j.ijhcs.2020.102498*.

[94] Smart Kalasatama (nd), "Smart Solutions" available at *https://fiksukalasatama.fi/en/building-blocks/*.

extra hour of free time every day?" is an excellent question, whereas "How do we make our cities smart?" is clearly not.

Closing remarks

Overall, the smart city discourse is changing. Just as rationalism eventually gave way to romanticism, the technology-centric view of the world is also coming to an end, while softer, more holistic values are gaining ground.[95] The EU has put forward a description of Industry 5.0 as the next "industrial revolution", specifically "putting research and innovation at the service of the transition to a sustainable, human-centric, and resilient European industry".[96] Similarly, the Cabinet Office of Japan has formulated a new guiding principle for innovation under the banner "Society 5.0", effectively replacing industrial values with social capital.[97] The economist Mariana Mazzucato has put forward a popular argument for "the value of everything", working with national and international policymakers to rethink financial systems, while Kate Raworth's "Doughnut Economics" theory is helping governments evaluate their growth plans in line with planetary boundaries. Together with these trends, there is an opportunity to redefine digital technology in the context of cities and planning, to put the health and wellbeing of people and places first.

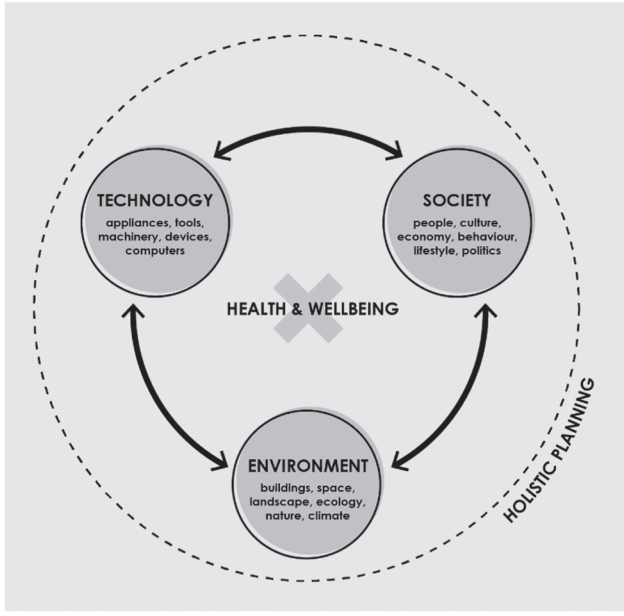

Figure 11: Holistic planning requires consideration for all three domains with the health and wellbeing of the overall system as the ultimate aim.

Responding to this, some might say that planning should stay in the lane of coordinating building and land use, and leave wider issues, such as climate change, biodiversity loss, heatwaves, drought, social inequality, obesity, immigration, mental health, unemployment, child poverty, political polarisation, and

[95] See e.g. A. Grybauskas, A. Stefanini, and M. Ghobakhloo, "Social sustainability in the age of digitalization: A systematic literature review on the social implications of industry 4.0" (2022) *Technology in Society* 70 available at *https://doi.org/10.1016/j.techsoc.2022.101997*.

[96] European Commission (nd), "Industry 5.0" available at *https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/industry-50_en*.

[97] E. G. Carayannis and J. Morawska-Jancelewicz, "The Futures of Europe: Society 5.0 and Industry 5.0 as Driving Forces of Future Universities" (2022) *Journal of the Knowledge Economy* available at *https://doi.org/10.1007/s13132-021-00854-2*.

digital illiteracy to other experts. Those same people might also say that new tools such as autonomous mobility, artificial intelligence, big data, modern methods of construction, 5G, augmented reality, and robotics are not for the planner to be concerned with. The problem with this response is that, while we may seek to functionally separate the planning of environments from thinking about the future of technology and society, in reality, the lines between these domains are already well and truly blurred. And as a consequence, changing one will always, inevitably change the others. Hopefully, this paper has helped shed a light on how we might embrace this complexity, and why we must. It is time for planners and public sector officials to take the reins back from the winners of the First, Second, Third, and Fourth Industrial Revolutions, and start raising our ambitions for accommodating social and environmental prosperity alongside technological innovation in the built environment.