Reimagining Smart Cities: reconsidering pluralism and data subjectivities

Marnina Lefebvre

Institute for Science, Innovation, and Society

University of Oxford

For the submission of the degree of MLitt

Supervisor: Professor Gina Neff

__Abstract__

This work explores multiple, competing sociotechnical imaginaries of smart cities in Oxford. I worked with two main groups in the field, Smart Oxford and Cyclox, the former the official smart city initiative of The City of Oxford, and the latter, a grassroots political pressure group for cycling in and around the city. Each group presented very distinct visions of the future, each imagining and mobilising data and science and technology in extremely different ways. Over the course of my fieldwork and post fieldwork analysis, drawing on the distinct and dynamic social and material conditions across the city, I observed multileveled and contested dimensions of smartness and found that smartness is messy, subjective, and never neutral. There are no core values or tenets that necessarily apply to smart practices or ideals across the board. This being the case, the different sociotechnical imaginaries at work in the city each work to mould different ideas of what it means to be 'smart', and what 'smarter' futures ought and ought not to look like. Further, each different imagining comes with distinct visions, assumptions, values, and perspectives of what data is, how it can and should be mobilised, and what futures are attainable and desirable.

This work adds to findings that follow the most recent call in smart city literature to move beyond the critique of unrealised ideals, and to study what is actually happening on the ground, exploring how smartness plays out in practice, and what it means for ordinary citizens' everyday lives and practices to live in 'smart cities'. It also highlights the challenges around smart city realisation and manifestation, offering a case that explores a less than fully successful attempt at smart city world building by an official smart city initiative with an officially endorsed narrative.

Contents

Introduction

Data is never neutral, nor is it impartial. This thesis explores Oxford as a 'smart city' in context, presenting two distinct case studies for analysis. This case study approach allows for the examination of a dominant and officially endorsed smart city imaginary, and a grass-roots counter-imaginary, comparing and contrasting the two. Briefly, imaginaries refer to imagined and materialised practices and ways of life and living that encompass material, moral, and social landscapes (Jasanoff 2015). Over the course of my work, I found that data and smartness are messy and subjective, there are no core tenets nor are there core values that apply across the board. In this way, the context and the people involved become ever more important in determining the shape and trajectory of said smartness. As such, there are multiple ways of imagining 'smartness' at work within the same city, moulding distinct ideas and notions of 'smart', each with a particular vision of the future, with separate values, hopes, practices, and purposes. My research, therefore, works towards the notion that data and smartness are never 'raw' or unbiased. It examines how data looks, and is, different from various perspectives, and how it is imagined and mobilised in different ways to suit different ends. Thus, my work contributes to a deeper understanding of the subjectivity and plurality of the role and practice of data and imaginaries in smart cities and how those processes play out on the ground.

Smart cities are at once products and processes of both sociotechnical and urban imaginaries. Thus, to aid in this exploration, I draw on ideas and concepts from the literature on sociotechnical imaginaries, urban environments and imaginaries, and the scholarship on smart cities. To better understand how imagined ways of life manifest and impact those who mobilise them and those caught within their general sphere of influence, there are an increasing number of calls to study how these imaginaries play out in practice, examining the reciprocally reinforcing relationships between ordinary citizens, organisations and institutions, and visions of the future. In other words, these complexities are being increasingly grounded and studied through the examination of the present practices of formal and informal institutions and actors mobilising a variety of resources and visions to create direction or to convince others of what the future will, and should, bring (N. Brown, Rappert, and Webster 2016a). Thus, moving beyond criticism, these literatures have begun to assess and observe what these future and

imaginaries look like as they are applied and lived in the city in real time. This is where my work contributes to the larger academic movement, as I map out two very different organisations in a so-called smart city, exploring their general makeup, their everyday practices, the role of science and technology within the context of their group, and their relationship to ideas and ideals of smartness.

The overall narrative of the thesis focuses on smartness and how data is imagined and mobilised, where each empirical chapter shows how different parameters shape and are shaped by different ideas and practices of smartness and how the corresponding sociotechnical imaginaries constitute and are constituted by those circumstances. While different visions and practices of smart will always be present in the city, and it is unlikely that they will be made commensurate, that is not to say that smart cities do not, or will not, 'exist'. Rather, perhaps as different forms and performances of imagination enact and are pulled through smart spaces in different ways, smartness and smart cities may, in fact, be the products of subjective and messy processes. Further, as I will establish, data is never neutral, so what this research shows is just how subjective these two different groups' approaches to smartness and the future of the city really are. All of this combines to provide a richer picture of the challenges around the imagining and practice of smart cities.

To begin, let us first look at the concept and phenomenon of 'the city'. Cities are diverse and complex amalgams of people, institutions, ideas, and practices. They are sites of convergence, where distinct urban imaginaries meet and disperse at every level across the city, where technology, data, material assemblages, individuals, and groups interact through the ideas and practices of the everyday. By using the term urban imaginaries, I draw on Sonja's definition (2000, 324) which refers to "the mental or cognitive mappings of urban reality and the interpretative grids through which we think about, experience, evaluate, and decide to act in the places, spaces, and communities in which we live". While different imaginaries coexist and jostle for legitimacy and power, their interactions do not result in the extinguishing or exhausting of one imaginary by another. Instead, they coexist in dynamic negotiation of the everyday and of the future. As such, cities respond to, are built on, and are mediated through pluralised and competing imaginaries. Thus, multiplicity and competition—whether in how the city is imagined, practiced, or structured—is the norm, and it always will be (Delina 2018).

Equally, those imaginaries respond to, are built on, and are mediated through the materiality of the city.

Cities are made and remade through a complex network of interactions, negotiations, and contestations which result in multiple and coexisting images and perceptions of the city that seek to give it a particular presence and identity (Cinar and Bender 2007). As social, spatial, and material phenomena in a constant state of redefinition, cities depend on the fluctuations of competing urban imaginaries (Estrada-Grajales, Foth, and Mitchell 2018). The city as 'lived complexity' (Chambers 2008) *requires* these alternative and conflicting perceptions and imaginaries (Amin and Thrift 2002). Urban space is in a perpetual state of structuration with the collective imaginary, where the composition of the urban hinges on the content of different urban imaginaries and these imaginaries hinge on materiality and the experience of urban space (Kelley 2013). This means that there is no single unifying imaginary of the city or of the future, nor are these imaginaries neutral or objective, because the different systems and networks that produce and are produced by these imaginaries are neither neutral nor objective. Urban imaginaries mark how the city is imagined and perceived as a place of everyday life. Urban space is invariably social and involves subjectivities and identities as defined by age, race, gender, economic status, education, religion, and much more (Huyssen 2008).

In the wake of the body of work dedicated to the social imaginary, including Durkheim's collective representations (2013 [1895]), Anderson's (1991) imagined communities, Appadurai's (1990)work on globalisation, Taylor's (2004) stipulation that the social imagination is central to the making of modernity, and Lefebvre's writings on the social production of space, reference to 'urban imaginaries' have become quite commonplace (Huyssen 2008)**.** However, its use and application is wide and varied. Some focus on media communications and images, technological innovation and deployment, cyberspace, others on traditional land rights and usages, while yet others on the linkages between hyperlocal, local, national, and international practices and flows (ibid). All of which (and more), when combined with customs, language, and everyday life and practice generate the urban imaginary (ibid).

What is missing from these conceptualisations of the imaginary are specific and detailed discussions of the role of science and technology in the development and shaping of

society (Jasanoff 2015). Anderson mobilises and consolidates his imagined communities through the medium of newsprint, but the role of technologies of communication have but small parts to play in his analysis and storytelling (ibid). While Appadurai looks at 'technoscapes' and the flow of technology, he pays less attention to the arguably central role of knowledge production and its materialisation in the development and anchoring of social imaginaries (Jasanoff 2015). When reflecting on the role of science and technology studies (STS) in examining the generation and propagation of new ways of governing science and technology, there are certain key questions that arise about how particular patterns of imagination and analysis generate visions of the future; how these images are constructed, contested, and stabilised; how they are practiced and how they aid the realisation of social and technological arrangements, and how they become enculturated in social thought and practice through the development of sociotechnical imaginaries (Felt et al. 2017). As such, where "science and technology were formerly generally regarded as the domains of facts and artefacts, they are now also associated with storytelling, imaging, and imagining" (McNeil et al. 2016, 457).

By examining two different groups within the city of Oxford, my research highlights the pluralistic nature of society and the subjectivity of urban imaginaries, serving to show that different imaginaries hold different assumptions and adhere to distinct values that shape and are in turn shaped by subjective notions and performances of smartness and sociotechnical imaginaries and practices. This plurality and dynamic competition render it almost impossible to imagine a future that is unified under one urban imaginary or one understanding of the city and how it is to be experienced. Even within a bounded geographical area, there is not 'one' city, but many. These different ideas and imaginaries of the city mobilise data and technology in distinct ways, emanating from different ideas of what constitutes data and technology, its value, and the role that it plays in shaping society and the future. We know society is pluralistic and in a constant state of negotiation and dynamic interaction (Douglas 1986). It follows, then, that cities cannot be understood in terms of one overarching identify of space and place. Rather, the city is found in many different cities in the same space, as formed by distinct forms and patterns of social order and organisation from which emerge distinct institutional practices and formations.

In a digitally mediated world, sociotechnical approaches to studying the city facilitate a deeper understanding of these negotiations and interactions. At its most basic, the term sociotechnical describes the inextricable link between humans, society, and technology. In today's world, more than ever before, technology saturates the city and sociotechnical approaches highlight the role of data and technology within this increasingly datafied built and social environment. In this way, data is inseparable from the social, material, and technical assemblages in which it is found. Bringing the imagination to bear on this increasingly digital and social world, and using Jasanoff and Kim's (2015) definition, sociotechnical imaginaries are defined as collectively held and publicly performed visions of attainable and desirable futures, underwritten by common understandings of forms of social life and order as achievable through science and technology. The study of sociotechnical imaginaries is an attempt to create and apply a framework to examine and understand questions of how social life and order are entwined and coproduced by questions and practices of science and technology. For empirical research, this means answering Jasanoff's (ibid) call to focus on the performative dimensions of society's self-reproduction and the enactment and re-enactment of its imaginaries as they relate to science and technology.

In practice, sociotechnical imaginaries focus on specific and detailed discussions and analyses of the role and materiality of science and technology in the development and shaping of society through sociotechnical imaginaries. What this means for cities is that sociotechnical imaginaries underlie and become key components of political decision making processes and social and cultural justifications. Thus, urban and sociotechnical imaginaries come to the fore when exploring the relationship between technology, science, and society in the city. In other words, notions of urban imaginaries need to be thought of *with and through* technology, rather than separately (Rose 2018).

In this way, scholars should shift from looking *into* the future of cities, to looking *at* the future of cities, focusing on the social processes of how urban futures are enacted, managed, and constructed in the present, by whom, and in in what context (N. Brown, Rappert, and Webster 2016a). Doing so allows scholars to ground the study of the future and of imaginaries in the present, exploring how imaginaries and manifestations of urban technologies shape and are shaped by recurring patterns of social order and organisation. Further, it is through the interaction between institutions and technologies that these sociotechnical imaginaries are

performed, bringing into focus the agentic roles within these assemblages and systems (Ruppert 2018a). Thus, these imaginaries have material outputs which have the power to shape technological design, channel public expenditure, and justify the inclusion or exclusion of citizens with respect to the presumed benefits of technological progress (ibid). As these imaginaries are mutually and recursively coproduced by different visions and values, they are manifested in and through different modes and forms of practice across the city. Sociotechnical imaginaries, therefore, form the building blocks upon which the future is imagined, enacted, and performed. Using these distinct and dynamic social, material, and digital practices that emerge and play out across the city, I was able to examine and dissect some of the contested, multileveled, and performative aspects and productions of smartness in Oxford. Thus, by observing the creation and enactment of alternative visions of the smart city, we can see how the coexistence of different sociotechnical imaginaries highlight the plurality and subjectivity of seemingly technical decisions, choices, and innovations as they shape and are shaped by different institutions.

Today, perhaps some of the most powerful sociotechnical imaginaries concern digital technologies (Ruppert 2018b). Data is everywhere, and data informs what we know about the universe (Gitelman 2013). With sociotechnical systems and imaginaries being put to work on urban imaginaries, the pervasiveness of the 'smart city' imaginary is perhaps not so surprising. As it stands, the 'smart city' is one of the most popular ideals behind the development and regeneration of cities worldwide (Cugurullo 2018b). That said, in practice, application, and scholarship, there is no definitional consensus on what a smart city is, what it should look like, or what constitutes smartness. Consequently, it is also understood throughout this thesis that as a result of the lack of consensus as to what a 'smart city' really is, there exists no universally accepted definition of smartness. That said, smartness usually refers to the subjective properties given to particular material objects, practices, or ideas by concerned groups for the purposes of imagining, creating, or maintaining a 'smart city' as understood by those mobilising the concept. Due to this, the smart city imaginary and ideal has manifested in many different ways and has been filtered through a variety of different and context specific politico-economies and cultures, thereby resulting in diverse built environments that claim the mantle of 'smart' (ibid). Generally, advocates of smart urbanism see technology and digital innovation as infinite sources of data and development, with the end result being the ability to sustainably power and manage the city (ibid). On the other hand, the smart city movement has also seen the rise of

social inequality in several cities, where there has been an uneven distribution of the benefits of smart technology (ibid).

Yet, in this thesis, I am less concerned with the difference and diversity of smartness across various cities and contexts, whether positive or negative, and more focused on the diversity and impact of imagined and manifested smartness within one city. Here, the smart city and practices of 'smart,' as mediated by the digital data and sociotechnical systems that comprise so-called smart-city innovations, provided the space to explore competing sociotechnical imaginaries within Oxford. More specifically, I engaged with two distinct and independent groups within Oxford, Cyclox and Smart Oxford, both working toward the betterment of the urban environment and attempting to shape the future of the city in smarter ways and contribute to the fight against climate change. While these groups will be discussed in the Methods Chapter, as well as thoroughly described and analysed in Chapters three and four, for the sake of introduction, Cyclox is a citizen-led, grassroots pressure group that aims to put cycling at the heart of Oxford's future, where, in their mind, cycling is the best and most efficient way to create a healthier and safer city for all. Their activities are underpinned by two strategic objectives. The first is, the creation and maintenance of attractive and healthy streets, enjoyed by all. Second, they work toward the establishment of safe and connected cycle networks. Smart Oxford, on the other hand, while also working toward a healthier and more sustainable future, seeks to create an environment and infrastructure that engages with digital technologies to support the generation and sharing of city information and to facilitate the development of technologically innovative city-related solutions more effectively, cheaply, sustainably, fairly, and inclusively.

What became abundantly clear from my time in the field was that the idea and practice of smartness is partial and subjective. Further, that some data will necessarily lead to different implications for different stakeholders. In examining and analysing each groups' desire to create smarter futures by combatting climate change through differing approaches to the management and control of mobility and the reduction of congestion, this work utilises the fundamental transport tension between Smart Oxford and Cyclox to show that smart city approaches and programmes of datafied cities need to be very careful because of the ways that data empowers and disempowers different kinds of stakeholders. This is not because stakeholders are or are not included but simply because data cannot serve as a neutral or

impartial ground that illuminates what approaches to take to mitigate the stresses and strains of urban life, or what the future ought or ought not to look like.

In other words, what I found was that smartness and the imagining and mobilisation of data and technology in the present, as well as for the future, differed depending on the context and institutional makeup of the group doing the mobilisation. In this way, different practices and attempts to manage the urban environment empower and disempower different actors and networks, shaping notions and approaches to technological innovation and change, as well as ideas of what the future ought and ought not to be. Thus, through the exploration of two separate groups within Oxford, I was able to uncover how competing imaginaries were framed, negotiated, and performed within and across the city. This, in turn, shaped how each group imagined and discussed smartness, its fit within their worldview, and its role in shaping the future. What this shows is just how subjective these two approaches to smartness really are, with Smart Oxford mobilising data as the occasion for change and transformation, with an unshakable conviction that data and digital technology is the only way forward, and Cyclox, on the other hand, weaving a counter narrative of community and social, more humanising, definitions of smartness. From this, we can infer that data is bias, there is no way to look at data from all sides, there is only partial and subjective views, with groups and individuals selecting some phenomena, while rejecting others.

In the chapters that follow, I will first review the relevant bodies of literature, where the work of the sociotechnical imaginary can be put to work on urban imaginaries and environments. This brings together the inextricable role of scientific and technological development and questions of social life and order as explored in the literature on sociotechnical imaginaries, urban imaginaries, and smart cities, each exploring how cities are imagined, practiced, and performed. I will then lay out the methods that were used to gather and analyse my time in the field and the subsequent data. This will be followed by two empirical chapters where I lay out and explore in detail my two participating groups, their makeup, organisational structure, everyday practices, visions of the future, and the sociotechnical imaginaries of smartness that inform said practices and visions. Finally, the discussion and conclusion chapter will bring both groups together to compare and analyse the findings outlined in previous chapters.

Chapter 1 – Literature review

In this chapter, I provide a selective review of three bodies of literature that, together, speak to the idea of coexisting sociotechnical imaginaries, the ever-subjective and fluid nature of data in an urban environment, and the ideation and enaction of 'smarter' futures. Namely, I review contemporary scholarship on; sociotechnical imaginaries, urban imaginaries, and smart cities. These concepts and corresponding bodies of literature provide a deeper understanding of how science and technology impact today's cities and how they are imagined and enacted across various levels of society. In reviewing these literatures, I examine work that addresses the emergence and existence of multiple imaginaries, both urban and technological, each moulded by distinct institutional contexts and those who mobilise and seek to make use of them, looking at whose imaginaries they are, how they are constructed, and how they are made visible in and through different ideas and practices of future making and social interaction.

Drawing on current theory, I look to the observation of patterns of social order, organisation, and participation within and across different social groups, and the role of the sociotechnical in shaping certain ideals and enacting multiple urban futures. Further, urban imaginaries can be understood as part of the process and outcome of the negotiations around different urban values, where these differences have implications for how technologies become sites of contestation and competing ideals, which in turn, has implications for how data might be used to serve different goals and purposes. Looking at both sociotechnical and urban imaginaries allows us to begin to unravel how different urban stakeholders make sense of technologies and the uses and futures they imagine for and from them.

First, I review the literature on sociotechnical imaginaries. Here, the literature speaks of shared understandings and forms of social life and order, ideas of public goods and bads, and behavioural norms. Using this as a base, this section focuses on the social construction of the sociotechnical imaginary and on digital data as inextricably intertwined with different ideas and understandings of the role of science and technology in shaping and enacting the future. In this way, digital data is situated, contextual, subjective, and serves as a medium for the negotiation and communication of social order and organisation. This foregrounds the fact that

not only do multiple imaginaries exist, but each serve different purposes, each provides partial visions of the city, and that, rather than there being a prevailing imaginary that extinguishes or exhausts counter imaginaries, multiple imaginaries co-exist and continue to survive in dynamic negotiation as manifested in the ways that different institutions imagine and talk about technologies and digital data. Finally, by acknowledging the increasing datafication of urban space and the technological mediation of today's cities, I conclude by examining sociotechnical approaches to studying the city and how imaginings and materialities of technology shape and are shaped by social and material conditions.

Next, to further explore the makeup and performative nature of today's cities, I explore literature on urban imaginaries, examining work from urban studies which focuses on the plurality and multiplicity of the narratives woven that create and recreate the city and its future. By way of exploring this, I draw on the idea of 'wicked problems', as coined by Rittel and Webber (1973), where urban problems are characterised by complexity, uncertainty, and value divergence. Wicked problems, then, provide a basis from which to talk of competing and divergent approaches and responses that address and emerge from actual and potential urban crises as they shape and emerge from different visions of the future. I then map different urban imaginaries that correspond to several themes in the literature; politics and governance, nature and the environment, commoditisation and privatisation, and digital and technological mediation. This further highlights the diversity and complexity of how the city is imagined and practiced, drawing on notions of plurality, conflict, and access to the city.

Finally, I draw on smart city literature as a way to reify the study of sociotechnical imaginaries and urban imaginaries, as the smart city and practices of smartness are at once urban and sociotechnical. Recent scholarship has begun to focus on smart cities as they are materially implemented and practiced on the ground, moving away from the study of smart city aspirations to the study of smart city applications. Like the work being done on urban and sociotechnical imaginaries, the recent work in smart city scholarship focuses on the distinct and diverse practices of different imaginaries which emerge from a city where there is no definitional or conceptual consensus on smartness, or singular visions of the smartest futures. With competing ideas of what 'smart' means and how it should be practiced, smart cities are products of messy, clumsy processes. I argue that there is no set smart function, no central node, or agreed conceptualisation of smart, nor need there be. This serves to demonstrate that

not only is it unsurprising that we find distinct and variegated practices of smartness, but it is to be expected.

By reviewing these three relevant literatures in terms of plurality, complexity, and competing interests I highlight the space where my work contributes to a deeper understanding of the subjectivity and multiplicity of the role and practice of technology, vis-à-vis smartness, in the city. These complexities and pluralities are part of the very structure of that society and how that manifests itself in everyday practice (Douglas 1986). Adopting this perspective on the literature, namely, that different imaginaries do not contribute to a singular future whole, suggests that there will only ever be partial accounts and partial accountability in these different understandings and practices within and pertaining to urban space. However, these partialities need not be seen as a flaw or the symptom of a dysfunctional system. On the contrary, the existence of partial, conflicting, subjective accounts is unavoidable and necessary for social groups to know who they are, what they stand for, where they are going, and how they are going to get there.

Sociotechnical imaginaries

In beginning to break down the various components and concepts that come together and inform the relationship between science, technology, data, and the city, both as it currently exists and its future, I will first examine the concept and literature relating to sociotechnical imaginaries. Sociotechnical imaginaries are collectively held, institutionally stabilised, and publicly performed visions of desirable and achievable futures, attainable through, and supported by, advances in science and technology (Jasanoff 2015). These collectively held and shared understandings of social life and order underlie, animate, and co-construct imaginaries. These imaginaries continually congeal and disperse and are in a constant state of negotiation as people shape and use imaginaries to enact the urban environment. Sociotechnical imaginaries, at their core, are an attempt to create an actionable framework for studying how questions of social life and order are coproduced and entwined with questions of technological and scientific advancement. The study of sociotechnical imaginaries occupies the space between two important literatures, the construction of imaginaries in political and cultural studies and sociotechnical systems in STS (ibid).

What has received relatively less attention in the study of coproduction and sociotechnical imaginaries in STS is a careful examination of the context in which debate and conflict over the role of science and technology in shaping the future emerge and become embedded in sociotechnical systems and every day practice (Tidwell 2018). It is this space that my work occupies, contributing to the emerging scholarship seeking to explain and analyse the existence and continued survival of multiple, competing, sociotechnical imaginaries within one city, a digitally mediated city, a smart city.

When reflecting on the role of STS in shaping and being shaped by social institutions, there are certain key questions that arise about how particular patterns of sociotechnical imagination and analysis generate different and competing visions of the future; whose futures are they; how are they constructed, contested, and stabilised; how do they facilitate the materialisation of different social and technological arrangements; and how are they made visible for those interacting with 'them', and for social analysts? It would seem that the answer lies in patterns of social order and organisation as they play out in practice and participation.

In this section, I first explore the notion of data as imagined, socially constructed, and subjective to show the inextricability of the social and the technological. The observation of distinct and divergent conceptualisations of the future, supported through science and technology and shared by distinct and divergent institutional groupings, renders the competitive field of sociotechnical imaginaries and practices visible. Sociotechnical imaginaries, like urban imaginaries, show how society is in permanent negotiation and flux. It is not only unsurprising that we would find multiple sociotechnical imaginaries within one smart city, it should be expected. We can see this at work in the creation and enactment of different visions of the smart city.

The literature on sociotechnical imaginaries addresses multiplicity, conflict, and competition through the analysis of different institutions, practices, claims, and materialisations of visions of the future. As they enact various imaginaries, different actors find themselves competing for space and legitimacy across multiple levels and scales (see E. Smith 2009; Hess 2015; Jasanoff and Kim 2015; J. M. Smith and Tidwell 2016; N. Brown, Rappert, and Webster 2016a). Scientific knowledge is not a transcendent mirror of reality, or of any one reality. Scientific knowledge is socially constructed by distinct and different worldviews and

it both embeds and is embedded in social institutions, practices, norms, values, logics, identities, discourses, and materials (Jasanoff 2004). The same can be said even more forcefully of technology (ibid). Thus, bringing the role of technology and the imaginary together draws together the normativity of the imagination and the materiality of networks and assemblages (Jasanoff 2015). It is through the interaction and co-constitution of society and technologies that these imaginaries are practiced and performed (Ruppert 2018a).

Science and technology alone do not determine how the urban is imagined and experienced. Rather, different worldviews and institutions shape and are shaped by how technology is imagined and experienced in and with the city. Further stabilising and mutually shaping these imaginaries are competing ideas of what the future ought and out not to look like, which dictate what characteristics are considered good or bad, where those who embody these good characteristics are celebrated, remembered, and subsequently woven into various collective narratives and cultural perceptions and biases (Douglas 1986). Sociotechnical imaginaries are culturally particular, and in the case of the urban, they reflect competing values, experiences, and visions of the city, focusing on the technologies and materialities of social life and organisation.

This bridge between the sociotechnical imagination and sociomateriality shows how observed facts of nature are filtered through different patterns of social logic and order, producing distinct understandings of how the world should, and does work (Jasanoff 2015). From an anthropological perspective, this echoes Douglas' (2004; 2011; 1986) work and understanding of social life, order, and organisation whereby people structure their ideas about nature and the social world in ways that are compatible with the social institutions and structures that they find themselves in at any given time. In the language of STS, this translates into the idea of coproduction (Jasanoff 2004). The notion of coproduction works from the understanding that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we live it (Jasanoff 2004). Scientific and technological knowledge and their material embodiments are at once products of social work and constitutive of forms of social life (ibid). Sociotechnical imaginaries are simultaneously descriptive of achievable social and technical futures, as well as prescriptive of the type of futures that can be achieved through the production and mobilisation of science, technology, and digital data (Jasanoff, Kim, and Sperling 2007).

Data is imagined, subjective, and social

Increasingly, many different sociotechnical imaginaries concern digital data-driven technologies (Ruppert 2018b). Digital data is everywhere, it informs what we know about the universe and all that resides within it (Gitelman 2013). Data itself needs to be imagined as data to exist and function as such, and this process of imagining data necessarily requires an interpretive base (ibid). Thus, visions and rhetoric concerning the role of data in society a vital element in many sociotechnical imaginaries (ibid). Data mobilises and is mobilised by the social and the technical in a multitude of ways. Within these ever-evolving sociotechnical systems in the digital age, there is an increasing propensity to view society (and the challenges and tensions of order and organisation) as a protruding nail that needs to be smashed by the (ostensibly objective) information/technology hammer (J. S. Brown and Duguid 2000). Colloquially, once one has a hammer, everything looks like a nail, once we have the technology, everything looks like a data source to be harvested, more often than not, uncritically, distilling society into a datafied space that is seen as almost unassailably neutral and objective.

At first glance, data appears to be 'before fact', where terms such as 'raw data'—with over one billion hits on Google at the time of this writing—initially appear unbiased and impartial (Gitelman 2013). However, data is always 'cooked' and is never entirely 'raw' (see Bowker 2005; Gitelman 2013; Neff et al. 2017). From the 'data before fact' perspective, there is the assumption that data is transparent, that the information self-evident, and it is the very foundation of truth (Gitelman 2013). Further, Gitelman (ibid) warns that if this enthusiasm for ever increasing amounts of data goes unchecked, it may further strengthen the faith in its neutrality, in its autonomy. However, in response to this faith in objectivity, an emerging field of scholarship, critical data studies, looks at the role of data in everyday social life, where some of the core tenets are that: data is inherently interpretive, it is inextricable from context, it is mediated through the sociomaterial arrangements that produce them, and it serves as a medium for the negotiation and communication of values (Neff et al. 2017). Rather than assuming neutrality and objectivity, how data is produced, gathered, sorted, and analysed requires critical engagement.

Objectivity has been, and still is, a central question around which academia has formed, and was a fixture of early debates about the scientific method (see Durkheim 1982 [1895]). Within STS, this notion of science, technology, and objectivity has also been widely covered, critically analysing our trust in numbers (Porter 1996), images of objectivity (Daston and Galison 1992), and the history of objectification and quantification (Hacking 2007). Claims of objectivity suggest an adherence to the sphere of objects and things as they exist in and of themselves (boyd and Crawford 2012). Conversely, subjectivity is seen as something that is tainted with various forms of individual and social conditioning, where human judgement and practice are often seen as contaminants that can, and should, be removed from data. However, judgement and practice are reflections of the values and choices that are found within the very structures of data, and should be understood as such, rather than something that needs to, or can, be extracted (Neff et al. 2017). This is not to say that all interpretations are created equal, rather, that all numbers and objects are not neutral (boyd and Crawford 2012).

Data is inextricable from the social, material, and technical assemblages in which it is situated. These assemblages, qua systems of thought, forms of knowledge, materialities and infrastructures, practices, organisations and institutions, determine how data is produced, how it is used, and for what purpose (Kitchin 2014a). In this way, data as interpretation and context mirrors the underlying logics and assumptions of social order and organisation. Thus, claims to objectivity are necessarily made by subjects, and are based on subjective observation and choices. In the convergence of computer science and social science, there has been a tendency among computational scientists to claim their work as the business of facts and not interpretation, yet, as soon as a researcher seeks to understand the meaning of something, the process of interpretation has already begun (boyd and Crawford 2012). As such, different institutional formations and social groups have their own norms and processes for the imagining of data, whereby different data sets harbour the interpretive structures of their own imagining (Gitelman and Jackson 2013).

Different institutions, contexts, and imaginaries have different, often conflicting and contradictory, ways of imagining and understanding data. To understand how ideas and concepts of data inform visions of sociotechnical futures and how that plays out within the city, we must understand how data, in its meaning and mobilisation, competes and is contested across institutions and communities (Fiore-Gartland and Neff 2015). Conflicting ideas of what

data means and how it can and should be used is made visible in the distinct ways that institutions and groups talk about data, what they want from it, and how they expect it to perform institutionally (ibid). Data is bias, there is no way to look at data from all directions, there are only partial ways, selecting some phenomena while rejecting others (Thompson and Wildavsky 1986). Rather than imaginings and materialities of data coming together to produce one whole, competing ideas of what counts as data, what it means, and what is to be done with it contributes to different sociotechnical wholes and practices.

Sociotechnical dynamism and competition

Sociotechnical systems and practices will always be pluralised and contested as there is no 'singular' or 'whole' imaginary that runs across all scales and levels of society. Nor are these imaginaries neutral or objective, this is because the different imaginaries that shape and are shaped by these systems are neither neutral nor objective. Much like the work on urban imaginaries, STS scholars find that not only do imaginaries operate across different scales and on different levels, but multiple imaginaries can and do coexist and compete within and across societal strata (Jasanoff 2015; N. Brown, Rappert, and Webster 2016b). These imaginaries are generated and practiced by organised groups such as: social movements, organisations or professional societies (ibid). For example, Burnham et al (2017) found that different actors construct their technological priorities according to their own sociotechnical visions of how those technologies can be used to serve a better future society, while simultaneously challenging and competing against the visions of their rivals. Similarly, when looking at the development of technological artefacts from the point of view of various social groups, it has been found that different groups have different views and perceptions of the artefact, attributing different meanings to it, leading to different social practices and engagements (see Pinch and Bijker 1984; Bijker, Hughes, and Pinch 1989; Aibar and Bijker 1997).

Developing our understanding of the multiplicity of imaginaries, Smith (2009, 462; McNeil et al. 2016) argues that there are "always multiple imaginaries at play in society, and within institutions, and they have very real effects in shaping programs and policies". Using the notion of imaginaries to capture mechanisms of governance, Smith (2009, 463) investigates how specific imaginaries emerge and prevail and are seen as the "best, most appropriate, or even inevitable". However, she argued that although there are always various imaginaries at

play, only a small number of these foundations have the power and dominance to inform education, research, and institutional development (ibid). Similarly, Jasanoff and Kim (2009) note that while multiple discursive framings and imaginaries exist, some emerge as dominant, embedded in the goals and priorities of state and public action. Both Jasanoff (2009) and Smith (2009) acknowledge multiple imaginaries, yet they conclude that only some imaginaries will dominate and prevail over time, where others are extinguished by the competition (McNeil et al. 2016).

More recently, scholarship has begun to document challenges to dominant imaginaries and the promotion of alternatives at national, regional, and local levels (Hess 2015), the heterogeneity of imaginaries within the same technological niche or industry (J. M. Smith and Tidwell 2016), as well as ideas of the future as contested objects of social and material action (N. Brown, Rappert, and Webster 2016a). This scholarship focuses on the processes of contestation and how differing values and interests produce alternative and counter imaginaries (see Delina and Janetos 2018; Delina 2018; Tozer and Klenk 2018; Schelhas, Hitchner, and Brosius 2018). Examining contested sociotechnical imaginaries of different institutions can reveal the dynamic flux and negotiation among actors and practices within the same city or niche, be it in the field of energy (see Bouzarovski and Bassin 2011; J. M. Smith and Tidwell 2016; Delina and Janetos 2018), bioenergy (see Levidow and Papaioannou 2013; Eaton, Gasteyer, and Busch 2014), science and technology studies and social movements (Hess 2015; 2005), or smart city conceptualisation and materialisation (see Datta 2018; Kitchin, Coletta, and Heaphy 2018; Shelton and Lodato 2019; Hollands 2008; Thomas et al. 2016).

Hess (2015) argues that mobilised publics can, and do, contest the official imaginaries, generating counter-imaginaries of the state, industry, and sociotechnical futures. Further, he also proposes that there are significant divisions among mobilised publics, or groups, both in terms of organisation and in terms of their frames and imaginaries (ibid). Thus, not only are there counter-imaginaries that exist in response to the 'official' imaginary, but there are also differences among and across various and competing counter-imaginaries. He suggests that the idea and use of the imaginary answers Geetz's (1973) call for "an interpretive science that attends to webs of meaning" (Hess 2015, 76). He calls for the analysis of imaginaries through the tracking and interpreting of oppositional imaginaries, where this analysis of contested

imaginaries is based on the idea that mobilised publics not only contest assumptions of official imaginaries but also create their own (ibid).

These different imaginaries embody collective fears of the potential damage caused by invention and innovation in pursuit of these futures, as well as what's at stake if there is a failure to develop and engage with emergent science and technology (Jasanoff 2015). Brown et al (2016a) propose a shift in focus from looking *into* the future, to looking *at* the future and how it is constructed and managed, by whom, and under what conditions (ibid). Like Smith (E. Smith 2009) and Jasanoff (Jasanoff and Kim 2009), Brown et al (2016a) focus on understanding how it is that some futures come to prevail over others, why once seemingly certain futures failed, and how alternative futures are marginalised as a consequence of more powerful visions. In this way, the sociotechnical imaginaries literature emphasises the moral and social dimension of technology, and how visions for what a good future should be like are linked with material features of technological systems (Burnham et al. 2017).

That said, while multiple imaginaries coexist in competition and dynamic flux, the valence and dynamic of those relationships are not set. Groups and institutions are not always diametrically opposed in practice. While underlying values and logics may not always align, states, industries, and institutions might see opposition as threats or as perspectives that need to be addressed to further facilitate coexistence and the possible realisation of the future (Hess 2015).

Competing sociotechnical visions not only encompass ideas of what the future ought and ought not to look like, they speak to distinct practices and performances that attempt to crystallise and bring about those futures. Recently, Brown et al (2016a) explored contested science and technology futures, not as futures *per se*, but the real-time activities of actors and institutions utilising a range of different resources with which to create 'direction' or convince others of 'what the future will bring'. While institutions work to turn their visions of science and technology into reality, other actors and groups contest the ways those technologies may or may not contribute to the risks and opportunities of their vision of the future (Eaton, Gasteyer, and Busch 2014). Exploring this material conflict, Hess (2005; 2007) coined the term *object conflicts* to describe the social tensions and controversies based in different understandings and design possibilities for technological innovations. His work in this area

focuses on "how the design choices between different variations of similar objects become sites for conflict among [a] range of organisational and individual actors" (Hess 2005, 520). Thus, technologies operate as performative scripts that combine values and interests, materialising and making tangible the invisible components of imaginaries (Jasanoff 2015).

Different futures are actively created and practiced in the present by way of claims and counterclaims over its role, potential, place, and value (N. Brown, Rappert, and Webster 2016b). The resulting contestation over these futures makes even more apparent the different material practices and mobilisations of scientific and technological risk, opportunity, and innovation in and through different imaginaries and futures (N. Brown and Michael 2003). Further, Strauss (2006) emphasises the need to locate the imaginary in concrete actors, social contexts, and material conditions. Drawing on Strauss' work, Smith and Tidwell (2016, 331) advocate a study of sociotechnical imaginaries as they are "criticised, taken up, and reframed by ordinary people" (Schelhas, Hitchner, and Brosius 2018). This can involve the reframing and reinterpreting of imaginaries to better reflect local conditions and visions (J. M. Smith and Tidwell 2016; Schelhas, Hitchner, and Brosius 2018), the emergence of sub-niche imaginaries to support different stakeholder motivations (Burnham et al. 2017), or social movements that resist more powerful imaginaries and create counter imaginaries (Hess 2015; Kim 2015).

Through the work of STS scholars, much of the conceptual development of these imaginaries has focused on employing a sociotechnical approach in the study of future-making policies and practices of nation-states and large institutions (McNeil et al. 2016). Yet, by bringing together the study of urban environments and imaginaries and the study of the sociotechnical, scholars are able to further dissect and analyse the multiplicity of imaginaries as they are taken up and moulded by different actors and institutions on a smaller urban scale, paying more attention to regional and local networks, communication flows, and how imaginaries are played out on the ground and in practice. Thus, studying sociotechnical imaginaries in this way and on different societal scales has shown that they can be generated and practiced by various organised groups such as: social movements, urban development organisations, or professional societies (Jasanoff 2015). As such, I will now look at sociotechnical systems and technology at the city level, which will then be followed by a discussion and review of the literature on urban imaginaries.

Digital and technological mediation and a sociotechnical approach to the city

City residents and institutions engage with a wide variety of technologies on a daily basis (Guy and Karvonen 2011). In this sense, cities are sites for the convergence of distinct sociotechnical imaginaries, systems, and artefacts where technology, data, and humans interact through the political, cultural, and economic happenings of everyday life (Bijker 1997; Hommels 2005; Guy and Karvonen 2011). These pluralities mobilise and imagine technology and digital data in very different ways, working from distinct and competing notions of what constitutes technology, what its value is, and what and how it can impact and help build the future. As such, it is plain to see that technological development does not occur in a vacuum, it is inseparable from, and implicated by, developments in the social sphere.

Many STS scholars look to notions of co-construction and co-production to reveal the workings of the relationship between the social and the technological (Jasanoff 2015; Guy and Karvonen 2011). This approach rejects the essentialist tendencies of technological determinism and social constructivism in favour of more nuanced positions where mutual shaping occurs between the two (see Misa, Brey, and Feenberg 2004; MacKenzie and Wajcman 1999; Bijker 1997; Bijker and Law 1992; Latour 1999; Jasanoff and Kim 2015; Guy and Karvonen 2011; Neff and Nafus 2016; Ruppert 2018a). Encased in each technological artefact and system is an assemblage of imaginaries, ideologies, dreams, calculations, political endeavours, and more (Guy 2009). This echoes Feenberg's (1999) approach in which he emphasised the need to avoid splitting technology and meaning, and focus on the struggle among different types of actors differently engaged with technology and meaning.

Often, contestations about technology and technological risk revolve around the idea of controlling the future (Mitzschke 2017; Giddens 1999). In many a digitally mediated imaginary, technological change is imagined to fundamentally shape the future of the city (Mitzschke 2017). Different actors and institutions attempt to shape contemporary social debate, policymaking, and practice with conflicting and contested imaginaries (ibid). In this way, sociotechnical development is often seen as uneven, where cities render visible the stark inequality of access to infrastructure service provision as mediated through technology and data (Guy and Karvonen 2011). Thus, technologies have the power to replicate and exacerbate

existing hierarchies and power imbalances rather than providing a consistent level of access and connectivity to all residents across the city (ibid). Here, research has shown that numerous options are weighed and contested by various actors and material conditions, with only select technologies 'succeeding' (Bijker 1997). As such, specific features of technology are connected to broader, external factors such as societal, political, economic, and historical contexts (Bijker, Hughes, and Pinch 1989; Bijker 1997; Hommels 2005).

Cities, then, as the product and process of multiple imaginaries and contestations coming together—be they social, technological, political, environmental, or entrepreneurial— cannot possibly hope to reflect or enact a single imaginary or vision of the future. Here, then, the sociotechnical study of cities and urban imaginaries prompts researchers to ask how and why a particular technologies and social structures have developed in tandem; what was the context within which certain technologies came to the fore, who was included in the development process; what material conditions influenced adoption or rejection; and what were the social, political, economic consequences? To further explore these questions, I will now examine literature on urban imaginaries, where urban landscapes and materialities are shaped by different values and institutions, which in turn, shape the types of sociotechnical futures that are imagined and perceived as desirable and attainable.

Urban imaginaries

Cities emerge from plurality and tension; they are diverse, variegated, and contested assemblages which are co-constituted and enacted through multiple institutional imaginaries, practices, and modes of participation and performance. Cities are not just constructions and productions of material and lived spaces, they are also spaces of social and collective imagination (Bridge and Watson 2003). In referring to urban imaginaries, I draw on Soja's definition (2000), and speak of the mental mappings of urban reality and the environment, as well as the interpretative mechanisms and processes through which we think about, experience, and behave in the places, spaces, and communities in which we live. To further understand the impact that the urban environment has on the study and production of imaginaries, on social order and organisation, the ways that urban stakeholders make sense of their surroundings, and on the imagined and practical uses of technology in those spaces, what follows is a selective review of the theorisation of the urban environment in urban studies. To be more specific, first,

I examine the relationship between the urban and imagination, whereby we see how, and in what ways, imaginaries, both social and sociotechnical, shape and are shaped by the environment that we live in.

This is further explored by the discussion of several prominent themes in the literature on urban imaginaries; politics and governance, nature and the environment, and the commoditisation of the city. Each of these themes have implications for how science and technology are imagined, used, and put to work on envisioning and manifesting brighter futures, which also impacts how data might be used to serve different purposes and goals. This further serves to show that different imaginaries hold different assumptions, all of which interact across the city and manifest in distinct, often contradictory, ways of viewing the environment, as well as holding different understandings of how to manage and coordinate everyday life.

Imagining the city

In the 1990s, during the cultural turn within urban studies, this understanding of the city as a complex and diverse assemblage came to the fore (Bridge and Watson 2003). Cities began to be conceptualised as spaces of cosmopolitanism and multiculturalism, as well as spaces of the psyche, memory, and the imaginary (ibid). Drawing on these paradigmatic shifts, contemporary urban studies continues to increasingly acknowledge and analyse the role of imaginaries in shaping cities, especially in relation to the future (Lindner and Meissner 2018). These ideas set out to consciously disrupt and blur the boundaries between the real and the imagined, between discursive and non-discursive domains, where space is simultaneously material, conceptual, experienced, and practiced (ibid). With this recognition that any vision or perception of the city can only ever be partial, notions of difference, fragmentation, complexity, virtually, hyper-reality, and digital mediation are thus embedded in contemporary stories of the city (Bridge and Watson 2003).

How cities are imagined, who imagines them, what they are imagined to be, and the plans for how they are to be actualised, impacts not only the everyday practice of urban stakeholders but also the materiality of the city itself (Bridge and Watson 2003). These imaginings, or urban imaginaries, refer to the mediation of urban environments by cultural

texts, whether visual and literary, audible and oral or high and low (Rose 2018). Urban imaginaries, those of the past, present, and future, are everywhere, across multiple social scales and levels. Urban imaginaries form part of our everyday lives and practices in the city, impacting not only how we structure our social relations and worldviews, how we move around the city, and how we interact with individuals and groups, but they also influence planning, policy making, city branding, and much more (Lindner and Meissner 2018).

In other words, urban environments reflect and shape different imaginaries and ways of perceiving social relations, they are an assemblage of different and competing social institutions, where institutions are features of different forms of social order and organisation (Douglas 1986; 2011; 2004). These forms and patterns of social organisation emerge as recurring types of behavioural rationalities or ways of life, where institutions and groups exhibit particular cultural biases and patterns of behaviour according to the social environment they are situated within at any given time (ibid). Throughout this thesis, social institutions are taken to be any non-random patterns in human behaviour, where rules of practice themselves are often not explicit, yet the resultant practices are. Institutions permeate all aspects of society, both formal and informal, in different ways, across any community or ecosystem, and on all social scales. They foster a sense of accountability or some duty to provide an account of performance and be subject to appraisal and either sanction or reward, however informal (Douglas 1986; 2011; 2004). In this sense, they are relatively stable, established, and recurring patterns of behaviour that are reproduced, lived, and practiced by groups, organisations, and individuals who find themselves within particular settings and rationalities (Rayner 2009). These ways of life constrain and enable patterns of practice, behavioural norms, and the rules by which social relations are organised and controlled.

At the turn of the century, urban sociologists began to scrutinise the relationship between the physical, social, and the imaginary in urban space, looking among the vast arrays of city structures and their meaningful articulation in the everyday lives of city dwellers (Eade and Mele 2002). These imaginings have consequences for the types of social, economic, and institutional practices and structures that occur and recur in the city and vice versa (ibid). Cities are, and always have been, constituted by different social institutions, where to speak of cities is to speak of the institutions that constitute them and the alternative ways that people organise their social relations and understand the world around them. Competition among these many

imaginaries becomes an occasion for the practices of negotiation, as people with different ideas come together in cities, with their networks of interconnection shaping how different people and groups perceive and live in the city in a multitude of competing, yet coexisting, ways (Bridge and Watson 2003). These different tensions—between facilitation and constraint, between actualisation and fantasy, between the individual and the collective—emerge in how the city is imagined, understood, and practiced (ibid).

Every individual, every group, every activity, every material space reflects and enacts different imaginaries at different times, rendering the plurality and social construction of the city visible (Bailly 1993). Imaginaries are as diverse and manifold as the social institutions that constitute the city, illuminating the multiplicity of experience and perception, and downplaying any one notion of the city as defining or over-influencing all others (Eade and Mele 2002). Thus, in this way, and many others, cities as ever-fluctuating products of complex networks and forces, including social, imaginary, political, and economic, operate both from the top-down and the bottom-up, where the competition among different urban imaginaries to shape the city and its future, reveals a complex permanent imbalance of power (Kelley 2013). There is no one imaginary, but many which shape and are shaped by the city in different ways and by different institutions, each highlighting some aspects and not others (Bridge and Watson 2003). These imaginaries, then, act and are acted upon through the production of the city in all its diversity and complexity (Eade and Mele 2002). That said, not all imaginaries are created equal, depending on the social, cultural, and political weight and strength of the institution doing the imagining, as well as on the economic resources that are available, some imaginaries are more dominant and accepted than others.

Competing imaginaries support and animate diverse and distinct institutional responses to the city in all its social and environmental complexity. In the 1970s, Rittel and Webber (1973) first identified these societal problems and complexities as 'wicked problems'. As originally defined (ibid), wicked problems seem incomprehensible and resistant to solution, these problems include issues such as urban planning, resource management, and climate change. Such problems have no definitive description and are difficult or impossible to solve due to increasingly complex, contradictory, or incomplete, ever-changing components, which are often difficult to identify, all of which is exacerbated by increasing heterogeneity and value conflicts (ibid). Wickedness, then, can be thought of as a combination of complexity,

uncertainty, and value divergence, and in this sense, many challenges and public policy issues that cities face are 'wicked' (Head and Alford 2015; Dodgson and Gann 2011). Competing social groups exhibit important and distinct differences in aspirations, values, and perspectives that confound the possibility of clear and agreed approaches to wicked problems in the city (Head and Alford 2015). Under such conditions of risk and uncertainty, these institutions each orientate towards particular approaches to wicked problems, with particular strategies and imaginings, all calling for different types of direct action (Rayner 2006).

When we examine different urban imaginaries' approaches to wicked problems, we can see the alternative, conflicting ways that people organise their social relations, perceive the world around them, and imagine and work to materialise different futures. Different groups and institutions tend to assume that the 'right' strategy (their strategy) will 'solve' these urban issues, and the problems of the city will begin to become controllable (Rayner 2006). However, unsurprisingly, within the overarching goal of mitigating the risks of wicked problems, nationally and locally, and given their inherent complexity, there are no objective definitions of core concepts such as urban equity, access, or risk, among others. Thus, urban policies that respond to these urban and social problems cannot necessary be meaningfully correct or false (Rittel and Webber 1973). There are no 'solutions' to these problems in the sense of complete and objective answers (ibid) as there are no singular or uncontested visions or imaginings of the future.

Mapping different imaginaries

There are many imaginaries, mobilisations, and visions of the city that can be explored to illuminate this plurality. There are the political imaginaries that shape and are shaped by urban governance, there are imaginaries that address actual and potential urban ecological crises, such as those represented by wicked problems, there are visions and practices that arise from and inform the idea of the city as a commoditised and privatised space, and there are the imaginaries that emerge from, and focus on, the city as an increasingly technologically and digitally mediated space. Reviewing these contested visions not only highlights the work that has been done on conflict and plurality in terms of the urban imaginary, it serves to demonstrate just how diverse urban imaginaries can be, and that it is unlikely that there will ever be a unified

vision of the future with shared understandings of equality, access, connection, or the social good.

Politics and governance

Imaginaries are intrinsically political. They shape and are shaped by socio-spatial relationships of inclusion and exclusion, empathy and apathy, and solidarity and segregation (Lindner and Meissner 2018). Different socio-spatial and political power relations produce and reinforce particular urban imaginaries, while these imaginaries simultaneously reproduce, and potentially reconfigure, those relations (ibid). Urban politics and governance are places where we can see tension and competition in and through urban imaginaries. Here, the politics of urban imagination is understood in broad terms as processes of making sense of socio-spatial conditions and they play an important role in the construction of different types of urban futures (ibid). These different futures are intertwined with how urban imaginaries envision the relationship between urban space, social justice, political economy, and the environment (ibid).

Much of a city's social and political dynamic derives from different institutions attempting to possess and appropriate urban space through displays of control, this contest is not only over physical terrain but all manner of public spaces – schools, places of leisure, or newspapers (Cinar and Bender 2007). Here, the prize is always different forms and degrees of legitimacy, security, and influence (ibid). Within the different imaginings and fragmentations of the city, there are both pro-urban and anti-urban elements and perspectives in each. While this is an oversimplification of the urban imagination, it serves to further highlight the dynamics and challenges of making sense of the city, both in terms of the urban present and the urban future. Those imaginaries that are orientated toward pro-urban sentiments tend to envision the city as a place of opportunity, as spaces of excitement, difference, enhancement, and engagement (Bridge and Watson 2003). Anti-urban imaginaries tend to perceive the city as a place of corruption, ill-health, alienation, pollution, and chaos (ibid). For example, urban designs, plans, and policies often, either implicitly or explicitly, express some version of anti-urbanism, where the city is seen as something that needs to be tamed, controlled, and made predictable (ibid).

These sentiments speak to the fears and anxieties of those imagining the city, representing ideas of both what the city and the future ought and ought not to look like. However, imaginaries are not *either* pro or anti-urban, they encompass the aspirations as well as fears of the present and the future, where different perceptions and visions aspire to, and fear, very different things. Urban imaginaries intervene in this relationship, or transition, between the urban present and the urban future, which raises questions of how future imaginaries are socially conditioned, shaped by power relations, and function in terms of political governance (Lindner and Meissner 2018). Urban imaginaries also raise questions of ownership, and who or what owns the future (Urry 2016; Lanier 2014). This capacity to own the future speaks directly to the nature of power and society (Urry 2016). As such, there is a need to carefully examine urban imaginaries, explore who participates in future making, and present actions set about to bring those futures to fruition (Lindner and Meissner 2018). This, then, speaks to Lefebvre's (1992) work on the right to the city, and brings in questions of what is at stake for the different imaginaries, whose imaginaries are they, whose interests they serve, and what type of city is being imagined.

Nature and the environment

The interaction between nature and the modern city is a complicated one, where urban nature is simultaneously a process of social and bio-physical change in which new kinds of spaces are created and destroyed (Gandy 2006). Ideas drawn from nature have played a significant role in the development of the 'ecological imaginary' in which ideas or metaphors drawn from the bio-physical and medical sciences have been used to understand the form and function of the city (ibid). Ecological and environmental imaginaries, which emerge to address and respond to crises and wicked urban problems such as urban planning, climate change, and resource management, can be found in visions of the sustainable city, the walkable city, the cycling city, or the green city (Bell and De-Shalit 2013; Owen 2009; Glaeser 2011; Gandy 2006).

In urban architecture, design, planning, and policymaking, visions of the 'smart', 'green', and 'creative' city set agendas to solve the acute challenges of energy consumption, food provision, waste and recycling, mobility and transport, and health and safety (Lindner and Meissner 2018). Unsurprisingly, within and across ecological imaginaries, there are sites of

contestation and value conflict, for example, urban imaginaries that enact cities as places for walking and cycling and those built for cars encourage and promote different values about, and approaches to, sustainability (Bell and De-Shalit 2013; Owen 2009; Glaeser 2011; Peet and Watts 2004; Nesbitt and Weiner 2001). Ideas of nature have played a defining role in the emerging tension between modernity and tradition, underpinning both radical approaches to urban design and at the same time questioning the very foundations of urbanism itself (Gandy 2006). This can be seen in the long-perceived antimony between ideas of the 'city' and the 'country' (ibid). Urban imaginaries that fuel and respond to these different perceptions of the city, be they pro or anti-urban or a mix of both, inform the way that different institutions face the city and its environment. For example, depending on the way that different imaginaries envision the relationship between urban space and the environment, institutions may approach the city through plans of creating a green city, conversely, they may also respond through acts of guerrilla-gardening (Lindner and Meissner 2018).

Critical scholarship has shown that imaginaries frequently tackle these urban issues in either partial or short-sighted ways, as each only forms partial solutions, often focusing on one particular area at the expense of others, or masks underlying transformations and movements (Lindner and Meissner 2018). For example, the garden city movement of the twentieth century attempted a reconciliation between 'city' and 'nature', yet it masked the transformation of nature under the impetus of capitalist urbanisation which sought to link landscape design and burgeoning middle-class aspirations (Gandy 2006). Ecological imaginaries have also been criticised as a cluster of dichotomous, ethological, and neo-romantic readings of nature (ibid). These imaginaries are widely conceived of in terms of an adjustment towards a notional 'equilibrium state' or as a set of processes that must be forcibly realigned towards a putative set of 'natural' parameters (ibid). In speaking of the former, Kaika and Swyngedouw (2012) have argued that while there is the general consensus that nature is under threat and in need of saving, emerging global environmental imaginaries, which champion technical fixes to solve an imminent global catastrophe, effectively neuter environmental justice as a radical political project by producing a post-political movement in which the only rational goal is to maintain the status quo (Swyngedouw 2009). What this shows is that different approaches and visions of urban nature and an environmentally sustainable future are motivated by different underlying assumptions and logics which inform how different imaginaries frame

environmental risk, what is seen as the 'objective' solution, and how a sustainable future might be achieved.

Commoditisation and privatisation

Imaginaries which respond to neoliberal globalisation and the accelerating worldwide mobility of goods, data, and people find themselves encountering other cities and other urban imaginaries as mediated through the exchange of goods and services, travel and tourism, labour migration, media, and digital technologies (Lindner and Meissner 2018; Huyssen 2008). With the rise of the 'global and 'international' city imaginaries, cities began to compete in terms of the economy, reputations, technologies, and social and human capital. This competition has seen cities increasingly adopt business-like strategies and management models, with one of the more overt aims being to brand and sell the urban experience (Kitchin, Lauriault, and McArdle 2015; Kornberger 2012; Jessop 1997). As such, city and place branding have become increasingly prevalent in city management, prompting questions such as who really *manages* the city, what bodies can claim management legitimacy, and who can claim to speak on behalf of it (Ashworth and Kavaratzis 2009).

Globally competitive and economically sustainable visions of the city, such as the smart city, have been driven, in part, by companies seeking new markets for their technologies, as well as by city administrations simultaneously seeking ways to do more with less through technical solutions, and to attract investment and boost local economies (Kitchin, Cardullo, and Di Feliciantonio 2019). This has been further aided by already well-established neoliberal political economies that promote the marketisation and privatisation of city services (ibid). In this competitive urban market, many cities around the world now frequently generate and participate in multiple ranking and indicator sets, using them to track performance, guide policy formation, and compete with other cities (Kitchin, Lauriault, and McArdle 2015). An early forerunner of the city as a present and future commercial centre can be seen in Jessop's (1997) 'entrepreneurial city' which placed entrepreneurial concern at the heart of urban design, and emphasised the need to formulate new combinations of economic and extra-economic factors which would ultimately produce a strategic competitive advantage with regard to urban positioning, branding, and competition.

However, most place branding imagining and practice only involves a one way communication of the brand, from urban managers (public or private) to the local populace, rather than meaningfully engaging them in the process of future making and manifestation (Kavaratzis 2012). Subsequently, there is often a gap between urban brands and the imaginaries which serve to promote and produce them as a commodity, and the reality of the city and the practices of its citizens and how they envision and participate in their future and its realisation. This is particularly relevant as critical scholarship sees a democratic deficit within contemporary processes of future making (see Urry 2016; Crouch 2016, 2004; Swyngedouw 2011; Mair 2013; Hay and Hay 2007). Select corporate, governmental, and technological elites have a disproportionately powerful role in imagining and making futures of the smart city (Lindner and Meissner 2018). For example, as articulated by Crouch (2016), the political power of particular transnational corporations have not only been able to heavily influence governments, but they have virtually become governing powers themselves. This embodies and leads to differing ideas of social good, justice, and of the future of the city and how that might be achieved.

In addition to social and political influences on the trajectory of urban neoliberalism, Lanier (2014) argues that the commercialisation of the city has only increased with the advent of the digital age, where digital information and place branding opportunities are turned into exceptional wealth by global information and communication technology companies, or 'server sirens', commodifying and monetising not only the city, but the future. In speaking of this particular interpretation of smart technology, Hollands (2008) warns that this type of technological city has the potential to become a smokescreen for ushering in a business-dominated informational city. Within these types of imaginaries, the corporate world generates a kind of digital utopianism which reflects the rise of the global technology corporation, in which are embedded certain assumptions of the person, rational action, and economic convention (Turner 2006; Urry 2016; Bridge and Watson 2003).

Highlighting just one of the tensions that exist between imaginaries of commoditisation and digital technologies, Hollands' (2008) early critique of the smart city was founded on the parallel between the imaginary of Jessop's 'entrepreneurial city' and the emergence and subsequent discussion of smart cities, arguing that one could conceive of smart cities as a high-tech variation of urban entrepreneurialism which focuses on economic agendas. In this way,

critical STS and social science scholars heavily criticise smart city discourse for envisioning urban futures predominantly in technological terms, which lends itself to processes of corporatisation and neglects issues of social inequality as well as the everyday skills and wishes of citizens (Lindner and Meissner 2018; Hollands 2008). To further explore the emergence, development, and critique of smart cities, I will now review the related and relevant smart city literature.

Smart cities

Smart cities, co-constituted by sociotechnical and urban imaginaries, are those which are digitally and materially mediated (Rose 2018). Making a city 'smart', or at least, 'smarter', is a strategy and idea that emerged to mitigate the risks of wicked urban problems through technological and scientific innovation (Chourabi et al. 2012; Goodspeed 2015; Stratigea, Papadopoulou, and Panagiotopoulou 2015; Kitchin 2016). In a smart city, digital urban data of many kinds are harvested, analysed, and mobilised to make cities run more efficiently, more sustainably, more securely, and ostensibly, more democratically (Rose 2018). Roche et al. (2012) emphasise 'technology in use' in their discussion of smart cities, calling attention to the use of digital artefacts in context. As such, digital data can affect urban environments in numerous ways, both socially and materially. Indeed, 'smart' is now part of many a city's imaginary (Rose 2018). Thus, smart city ideas and imaginaries should be viewed not only as constitutive elements of sociotechnical and urban imaginaries, but also as a reciprocal sociotechnical programmes of action and practice (Goodspeed 2015).

Cities, as the product of multiple contestations cannot possibly reflect single, unitary notions of smartness. The plurality and divergence of smartness, as reflections of distinct sociotechnical imaginaries, is not something that can simply be eliminated through compromise or persuasion, it is fundamentally part of what it is to be a smart city. We see it in sociotechnical imaginaries, in how technology and digital data is constructed and contested through different visions of sociotechnically enabled and enacted futures. We see this in urban imaginaries, in the multiple and competing visions that cities have, and we see it in the ways we envision and talk about technology and data. And we see it in the diverse and distinct notions of smartness as practiced by so-called 'smart citizens'. To situate the smart city, I briefly examine its early imaginings and development. I then focus on the emerging strand of

critical work in the social sciences that moves beyond the critique of those early visions and instead, focuses on the messy and contested processes and outcomes of smart cities and smart citizens as they actually stand and are practiced. This is where my work contributes to a deeper understanding of the relationship between smartness, ordinary citizens, who may or may not know they live in a 'smart city', and local organisations. In this way, I not only look at the sociotechnical and urban complexities of a so called smart city, but following the call to study smart cities as they actually exist on the ground, I map out, in practice, two very different organisations and their relation to said smartness.

Introducing smart cities

While early smart city imaginings have been heavily criticised, they have nevertheless informed smart city discourse and the themes around which that discourse has developed, critical or otherwise. Smart city scholarship and critique initially focused on utopian ideals based largely on the idea of the emancipating role of technological progress (see March 2018; Hollands 2008; March and Ribera-Fumaz 2016; Gibbs, Krueger, and MacLeod 2013), evocations and fears of the surveillance state and the marginalisation of excluded and vulnerable citizens (see Hollands 2008; Vanolo 2014; Taylor Buck and While 2017; Greenfield 2013; Calzada and Cobo 2015), and the technocentric futures and neoliberal underpinnings and logics of various smart city iterations (see Söderström, Paasche, and Klauser 2014; Greenfield 2013; McFarlane and Söderström 2017; Luque, McFarlane, and Marvin 2014; Hollands 2015). Although the smart city "can mean different things to different cities" (Hollands 2008, 310), or indeed, different things to different institutions and groups within a city, the concept is underpinned by the promise of addressing meta-issues, or wicked problems, of climate change, urbanisation, citizen engagement, and resource management and efficiency (Taylor Buck and While 2017).

Yet these issues are contested themselves, each without objective or widely accepted definition, where different institutions perceive the risks and potential mitigating strategies differently. Unsurprisingly, in attempting to respond to wicked problems as characterised by complexity and value divergence, smart city definitions and conceptualisations faced much the same problem. In the early stages of imagining and defining the smart city, being labelled a 'smart' usually meant that a predefined list of criteria were met or achieved, where being

'smarter' often meant that one so-called smart city had outcompeted another (Hollands 2008; Vanolo 2014; Kitchin 2014b; 2014c). In seeking to define and identify the constitutive elements of smart cities, and using these elements to construct league tables and rankings (Kornberger and Carter 2010; Kitchin, Lauriault, and McArdle 2015), much of the early smart city discourse drew on Giffinger and Pichler-Milanović's (2007) six key characteristics:

- Smart Economy: the city's general competitiveness and entrepreneurship, flexibility of the labour market, and innovation
- Smart Environments: the amount natural resources, levels of pollution, sustainable resource management etc.
- Smart People: the overall levels of qualification, affinity for lifelong learning, and participation in public life
- Smart Living: general quality of life, health conditions, housing quality, and access to cultural and infrastructural amenities and services
- Smart Governance: participation and decision making processes, overall quality of political strategies, and public and social services

These characteristics were present, in one way or another, in much of the early smart city scholarship (Vanolo 2014). Much like the urban problems these dimensions were said to be addressing, these smart criteria lack clear definitions, making it possible for them to be mobilised to suit the ends of those doing the mobilising, thus becoming sources of contested meaning themselves. While these dimensions and elements provided a list of potential present and future aspirations of urban 'smartness', areas where smartness could (and should) be mobilised, and what smart *might* encompass, the definition of smartness was, and is, contentious and contested. Far from providing clarity on what defines a smart city, each dimension presents a hollow vessel into which a wide array of conceptualisations and ideas can be poured, ultimately supporting each pourer's motivations and visions of the future. That said, these criteria have been, and still are, used in many different, and often incommensurate, ways by many different institutions (ibid).

What this means is that there is no 'one' idea of what constitutes a smart city, no 'one' smart future, or 'one' unifying imaginary which encompasses the smartness in and of the city (Nam and Pardo 2011; Hollands 2008; Vanolo 2014; Dameri and Cocchia 2013). However, I am not seeking to unsettle, displace, or unduly criticise smart city scholarship up to this point. Rather, I seek to focus on the emerging critical work in the social sciences on the imagining and practices of smart cities, citizens, and institutions. I examine the connections and dynamics that lie at the confluence of competing sociotechnical imaginaries and practices of smartness within the same smart city.

Smart cities in practice

Recently, critical social scientists, predominantly urban scholars, have begun to examine the applications and realities of smart city imaginaries and initiatives in all their variegated plurality and complexity. As the study of smart cities continues to develop, this emerging area of study conceptualises smart cities as complicated and dynamic assemblages of technologies, people, policies, data, products, and discourses which are in constant negotiation with material culture, space, and place (Rose 2017). These assemblages speak to more than just the 'idea' of the smart city, they draw in the materialised smart city, and the smart city as it actually exists. In this growing body of critical scholarship, early critiques were predominantly addressing the large body of literature on the 'yet-to-be-built' green growth smart city in all its utopian glory (see White 2016; Greenfield 2013; March 2018; Glasmeier and Christopherson 2015; Vanolo 2014). To date, however, there has been less of a focus on what is happening on the ground and on the interplay between citizens and smart city ideas, or partial smart cities, as they may be (see Shelton and Lodato 2019; Glasmeier and Christopherson 2015; Caprotti et al. 2017). As such, there have been recent appeals for comparative and empirical studies and accounts of smart cities and how and in what way they are being realised in tangible and ordinary spaces (see Wiig and Wyly 2016; Shelton, Zook, and Wiig 2015; Kitchin 2014c; Karvonen, Cugurullo, and Caprotti 2018).

To know a smart city, one must look at the city and its imaginaries in context, examining how it is actually constructed, developed, lived, filled with meaning, and practiced. Smart technologies and visions are assembled by particular institutions and interests, and as such, they engage in the messy practices of selective application in and across different social settings

(Luque, McFarlane, and Marvin 2014). To further understand these dynamics and messy entanglements requires an analysis of the different ways that social institutions and individuals organise and practice their social relations, their ideas and mobilisations of science and technology, and the ways that they perceive the world around them. Thus, practices of smart, or practices of different types of smart, come to mean different things to different people. Here, smartness, both the social and material, is constituted by shifting and dynamic elements, where mediators of smartness are imagined, connected, and performed in a myriad of ways (Rose 2018).

While 'smart urbanism' seems to be everywhere you turn, in practice, the agenda and material realisations are uncertain, usually only partially developed, and often contested (McFarlane and Söderström 2017). This has given rise to calls to further understand the 'actually existing smart city', rather than the idealised, unrealised imaginary (Shelton, Zook, and Wiig 2015). This particular strand of study focuses on the complexity of the smart city and the ways it has been implemented and practiced in particular locations (ibid). For example, Odendaal's work (2015) in Cape Town, and Towsend's work (2013) both focused on the tensions and contested realities in smart city environments which emerge from different visions and materialisations of smartness (McFarlane and Söderström 2017). Similarly, Wiig (2016) presents the case of Digital On-Ramps in Philadelphia which emerged from IBM's work and involvement in the area and proposed a social-media style workforce education application to train low-literacy residents for work. He argues that while the rhetoric of digital and transformative change works to brand and sell the city, the reality of projects such as these rarely meet expectations, as the rhetoric addresses new jobs and industries in the future, but fails to take into account the actual and material issues of the city in question (ibid). In much the same way, Shelton et al. (2015) trace the emerging and conflicting data-driven understandings of how different urban spaces and problems are imagined, highlighting that data and smart projects are never objective or unifying.

This gap between utopian, commercial, and technocentric imaginaries of the smart city and the smart city in practice is perhaps one of the most critical contradictions that smart cities face (March 2018). Increasingly, studies are exploring the potentially deleterious effects that smart imaginaries and initiatives are having on social cohesion and equal access to the city, whereby smart technologies can be seen to deepen and enhance urban disparities and the

exclusion of particular groups and stakeholders (see Glasmeier and Christopherson 2015; Graham and Marvin 2002; Luque-Ayala and Marvin 2015; March 2018). Smart technologies and the digitisation of some urban services have the potential to negatively impact ideas and processes of social justice and equity as social groups with limited access to digital resources and connectivity may find themselves isolated and marginalised as a result of this lack of access (Angelidou 2014). Similarly, other studies have found that smart city strategies and policies reinforce existing power disparities (Viitanen and Kingston 2014) while yet others have demonstrated that some smart initiatives and technologies improve the lives of particular groups and institutions while sidestepping those of vulnerable citizens (March and Ribera-Fumaz 2016; March 2018).

In response to this scrutiny, there has been a gradual shift in focus from discussing and analysing smart cities and smart strategies to a more direct focus on 'smart citizens' (Shelton and Lodato 2019). So, while smart city platforms promise to foster social and cultural equality, fairness, and access to improved and efficient public services, what of those who are less capable, those who are not as 'smart' or 'innovative' (Hollands 2008)? This process of social gentrification can be seen in various urban development programmes and economic development policies, where the purpose of attracting educated and skilled people is a central focus (ibid). This is to say nothing of whether these 'smart citizens' migrate to said city, or whether they are *created* from the already entrenched populace. As cities continue in their attempt to actualise their visions of a 'smarter citizen', inequalities of work, housing and neighbourhood, and general spatial dimensions become more obvious (ibid). In an attempt to reimagine the smart city, Kitchin (2018) calls for its humanisation, shifting the more anticipatory focus of smart cities, to one that looks at social justice and addresses persistent inequalities, prejudice, and discrimination, and is rooted in notions of fairness, equity, ethics, and democracy.

Cowley et al. (2018) argue that the publicness and practice of UK smart cities are far from one-dimensional and that citizens are not necessarily absent. They propose, instead, that the great variety of public practices suggests that the rhetorical claims about the smart city being citizen-centric are not straightforwardly empty (Cowley, Joss, and Dayot 2018). To that end, they identify four modalities of 'publicness' which frame how citizens are positioned within smart cities; citizens as consumers of services; citizens as entrepreneurial creators and

innovators; citizens as active decision-makers and deliberators; and grassroots community activists (ibid). Conversely, Shelton and Lodato (2019) argue that despite the increasing centrality of 'citizen-centric' approaches peppered throughout general smart city rhetoric, actual citizen remains largely excluded from participation in decision making processes and strategies (ibid). What gets left out, are questions about how citizens in those cities feel about living in these 'new' environments, and who stands to gain and lose (Thomas et al. 2016; Hollands 2015).

While the 'smart citizen' is frequently seen as a foil for those more stereotypically top-down visions of the smart city, the actually existing smart citizen plays a much messier role, one that is ambivalent in practice (Shelton and Lodato 2019). This can be seen as the citizen figure gets deployed discursively in the everyday practice of smart city-making, as well as in the existing practices of citizens participating, or not, in these programmes (ibid). Highlighting this dynamic, Thomas et al.'s paper (2016) explored citizen perspectives of smartness in 'smart cities', finding that not only were most participants unaware of the smart city concept, when further discussed and explore, the citizens' perspective of smartness and smart futures were in direct contrast to the scope and scale of not only the literature that was explored, but also to the grand visions of the ethereal high level visions and strategies of governments and larger bodies and organisations.

In exploring role of the 'actually existing smart citizen', Shelton and Lodato (2019) propose the existence of two ways that they are framed and mobilised by those guiding smart city planning initiatives, that of the 'general' citizen and the 'absent' citizen. The general framing speaks to the broader, more universal, unspecified citizen as they are deployed to justify smart city policy making which often fails to take into account the complexities and various forms of social and spatial urban inequality (ibid). Yet, despite the discursive centrality of the general citizen in the way that these projects are imagined, spoken about, and practiced, the existing citizen remains largely absent and excluded from participating in smart city planning and strategy making (ibid). This speaks to the contradictory and conflicting way that smart citizens are imagined and practiced in many smart initiatives. As such, there seems to be an almost conspicuously absent or partially-present smart citizen in practice, where there is the constant negotiation between presence, absence, centrality, and marginalisation that is played out against the backdrop of the sensed, modern, emergent city.

Further analysing the dominant ways in which smart citizens are framed, Kitchin and Cardullo (2019) focus how citizens are imagined and engaged by different smart technologies and specific models of citizenship within smart cities. Evoking Arnstein's (1969) ladder of citizen participation, Kitchin and Cardullo (2019) deconstruct notions of smart citizenship to measure civic inclusion, participation, and empowerment, revealing that most 'citizen-centric' smart initiatives are yet grounded in stewardship and civic paternalism rather than meaningful and impactful engagement and empowerment. Their work assesses levels of participation across various smart city initiates within Dublin, revealing the distinct types of practice and participation of smart citizens within the bounds of one city, demonstrating the different and messy practices of smart participation horizontally as well as vertically. What both Kitchin and Cardullo (2019) and Cowley et al. (2018) found suggests that many initiatives yet reinforce a view of citizens as mere recipients of these initiatives rather than fundamental co-producers (Shelton and Lodato 2019).

These recent strands of scholarship focus on empirical and comparative accounts of contemporary smart cities and citizens reveal how digital technologies and smart agendas are being situated in political, social, and material contexts. The empirical findings reflect the diversity of current applications of smart urbanism, shifting focus from technological and utopian promises to smart cities in practice (Karvonen, Cugurullo, and Caprotti 2018). These practices demonstrate that 'smart' changes cities, and cities change 'smart' through iterative process of embedding, imagining, and situating (Carvalho 2014; Kong and Woods 2018; Karvonen, Cugurullo, and Caprotti 2018). Haarstad (2017) argues that the definition of the smart city is far less important than what these cities actually 'do' and achieve in practice. In this sense, these works are beginning to move beyond criticism to observe and assess the processes and outcomes of those activities, practices, and visions unfolding on the ground, both the positive and negative (Karvonen, Cugurullo, and Caprotti 2018).

Through the analysis of Hong Kong and Masdar, Cugurullo (2018a) shows that visions that are promoted as cohesive and coherent urban spaces and environments shaped by homogeneous imaginaries are, in fact, fragmented cities made of disconnected and often incongruous pieces of urban fabric which often repurpose traditional, chaotic urban models. Similarly, March and Ribera-Fumaz (2016) examine the contradictions in the making of Barcelona's 'self-sufficient city' vision, where they explore the inconsistencies between the

'grand visions' of equal access and social equality, the implementation of these visions, and their impact on vulnerable citizens. While yet other studies explore, although not uncritically, the possibilities of integration and alignment as presented by smartness and how it may be moulded, integrated, mobilised, and reimagined to address health and wellbeing (Trencher and Karvonen 2017), existing environmental agendas (Burton, Karvonen, and Caprotti 2018), energy infrastructures (McLean, Bulkeley, and Crang 2016), energy efficiency and smart grids (Parks 2019), and smart approaches to sustainability (Trivellato 2017). It is only through this grounding of the research in the actually existing cities where the visions, policies, and practices being constructed and implemented that we can further understand the complicated and dynamic interplay between the promises, perils, and practices of smartness in smart cites (Shelton, Zook, and Wiig 2015). These studies ground and contextualise smart urbanism and the imaginaries that inform them, highlighting the messy, diverse, and heterogeneous nature of cities.

Shelton et al. (2015) argue that smart technologies and interventions are always awkwardly integrated into existing social, spatial, and material conditions. There are always tensions among stakeholders, their agendas, and existing urban infrastructures and configurations, but smart city advocates rarely acknowledge the apathy or direct resistance that their activities engender (Karvonen, Cugurullo, and Caprotti 2018). Disharmony is important because it reveals the marginalisation and exclusion of particular stakeholders (Kong and Woods 2018), and highlights different interpretations and imaginaries of desired urban futures where difference should be encouraged and valued rather than being swept under the carpet or disregarded (Karvonen, Cugurullo, and Caprotti 2018).

In their work on a shared street initiative in Chile, Tironi and Valderrama (2018) identify multiple frictions among stakeholder ideals and motivations. In this and other works (2018; 2017), they employ and encourage an 'idiot' perspective to learn from divergence and non-conformity (Karvonen, Cugurullo, and Caprotti 2018). The appearance and pronouncement of the so-called idiot refers to the unexpected, and sometimes disturbing noise that reminds us that there is always something that doesn't fit the norm, saying something you do not want to hear, or cannot understand (Tironi and Valderrama 2017). Idiot data, therefore, challenges ideas of intelligence, entanglement, and coherence that are often associated with the pronouncement of smartness (ibid). Additionally, these seemingly illegitimate contributions

challenge us to consider how cities and practices are held together, how the urban unfolds as a site of engagement, and how communities and practices often contribute as disruptive agents (Gabrys 2016). If the data doesn't fit the desired model, it should not be dismissed or discarded arbitrarily. The value and importance of these datasets lie in their capacity to indicate that something is making noise or is nonsensical, revealing the partiality of datafication, and the need to reframe the situation (Tironi and Valderrama 2017).

Yet for all the messiness, idiocy, fragmentation, and contestation, these dynamic tensions and relationships are inextricably sewn into the very fabric of smartness, as with sociotechnical imaginaries, as with urban imaginaries. While it is widely acknowledged that it is unlikely that these distinct visions, versions, and practices of the city will ever align to form a cohesive whole, that is not to say that it is necessarily something to be strive to overcome or be strenuously combatted. It is unavoidable and even necessary for the continued coexistence of the constitutive competing imaginaries and practices of social institutions. In this way, the actually existing smart city, the diverse and fragile practices of smartness demonstrates and renders the continual negotiation and flux of social order and organisation visible. This is the key dynamic that motivates this work, the unavoidable and continual subjectivity and messiness of imagining and practicing smartness as mutually co-produced in and through sociotechnical imaginaries in an urban environment.

Chapter 2 - Methods

This study was grounded in a longitudinal ethnographic research of two groups within the city of Oxford, seeking to explore the dynamic relationship among competing sociotechnical imaginaries of the smart city as they shape and are shaped by public discourse and practice. These competing imaginaries not only fought over the data but about its construction and the parameters around which that data was to be generated, collected, analysed, and mobilised, and what it would mean to have a smart city. The two groups I worked with were: Cyclox (a citizen-led cycling advocacy group) and Smart Oxford (a meso-level smart city initiative).

The following section addresses my methods, discussing how my project came into being, the challenges along the way, and how these were overcome. First, I shall situate the reader with regard to my field site, providing the context within which my work developed. Following that, I will detail my entry and engagement in the field and will focus on methods such as participant observation and engagement, semi-structured interviews, informal individual and group interviews, and thematic and textual analysis. This chapter will then conclude with a discussion on the methodologies through which my research was informed.

Throughout this discussion, I also address the ways that I balanced my role as an 'insider', working with my participant groups, and my role as a researcher studying said groups. This balancing act was not only an internal process, but also a relational and intersubjective one. By variously aligning with and detaching from these groups, I attempted to avoid being seen as one of the main 'implementers' or 'motivators'. To do this, I decided to get involved in targeted ways, with specific points of engagement and with particular projects. These projects included (but were not limited to) the development of advocacy consultation policies, website redesign, engaging with position papers, and engaging with technological practices and performances of smart projects and plans within a smart city initiative. While I actively engaged in these projects and activities, occasionally contributing content, voicing opinions, and helping to shape them in small ways, I was not the driving force behind the set goals, I was not a decision-maker, and I did not participate in any committee or board meeting votes, formal

or otherwise. In this way, I was able to go in and out of the field in an active and meaningful way, without being seen as one of the main implementers or drivers.

Situating the field

The choice of Oxford for my field site was not only a pragmatic one, as it is my place of residence, first and foremost, it was chosen because the Smart Oxford project was in its early stages of development, and I was initially able to secure access to the governing board, who were enthusiastic about my participation. In addition to the appeal of having access to a smart project as it was being formed, as well as access to the Smart Oxford board, I also had a variety of friends, networks, and acquaintances that provided a first point of contact and initially facilitated access to these groups. In this way, living in Oxford was a valuable asset for negotiating access as well as enriching my ethnographic content and encounter.

Before I discuss my methods, I will briefly situate the City within its broader social and industry trends. Oxfordshire has an approximate population of 682,400, and Oxford City's population is approximately 154,600 (County Council n.d.). In the city itself, due to the presence of two universities, the City of Oxford is well positioned in the higher education sector, with a large number of people employed by the universities, hospitals, and the public sector in general (ibid). Additionally, according to the 2011 census (which is the most current), 24 per cent of the adult population are full time students. Oxford's academic institutions contribute to the international reputation of its scientific and technological sectors, attracting global talent ('Social Trends in Oxford | Oxford City Council' n.d.). This particular aspect of the City's character will provide the space to investigate developing practices in relation to social and material practices, and the emergence and establishment of new ways of thinking and being in the city, or more simply, what we know and how we know it.

According to the 'Social trends in Oxford' report, the population of Oxford grew by 16,500 residents between 2001 and 2011. Within this period, the number of UK-born residents did not increase by any significant amount; the population increase was mainly due to immigrants choosing to live, study, and work in Oxford. As far as the industry makeup of Oxford itself, it goes without saying that industries evolve, change, and fluctuate in response to changing social, economic, and technological environments. In its recent history, Oxford has experienced the rise and decline of the motor manufacturing industry, and is now experiencing

a rise in employment in the higher education industry. This shift in employment contributes to the County's knowledge economy, as the city can boast the third highest proportion of 'knowledge intensive service jobs' of any UK city, with 'knowledge intensive business services' comprising 32.48 per cent of its industry structure (ibid).

Economically, relative to income earnings, Oxford has the least affordable housing in the UK. According to the Oxford City Council, of the 85 areas that comprise Oxford, 12 are among the 20 per cent most deprived areas in England. These areas are characterised by low income, low skills, and relatively higher levels of crime. Those living in these areas have a shorter life expectancy of 6 years, compared to those living in the least deprived suburbs. Additionally, one quarter of Oxford's children live below the poverty line.

Entering the field

I began my fieldwork in 2015, initially focusing solely on the Smart Oxford initiative, run by the Smart Oxford project board and set up through the Oxford Strategic Partnership's Economic Growth Steering board. In January 2015, the Smart Oxford project board wrote a report entitled *Smart Oxford – A Learning City for the 22nd Century* (Aldridge et al. 2015), which set out the goals, principles, and strategic foci of the initiative. As an urban development programme, Smart Oxford envisions a city where innovative ideas, engaged and participative citizens, and stakeholders coordinate their efforts and resources to build a city that develops and deploys new technologies to "enhance [the] understanding of itself as a living, breathing community, and achieve understanding and consensus on how it should change, to become equitable, sustainable, prosperous, and resilient" (Aldridge et al. 2015, 3). My first point of contact was through a member of the Knowledge Exchange and Impact Team for at The University of Oxford. His role was to facilitate networks and partnerships across the University, as well as within and across the public and private spheres. As a member of the Smart Oxford board, he was able to introduce me to the board, supporting and endorsing my involvement and research. Through this endorsement, I was given a standing invitation to attend the monthly board meetings.

While the board were initially very enthusiastic about my involvement, with the initiative in its infancy, it was difficult to immerse myself in a group who were themselves

struggling to come together in a cohesive and structured manner. The members were all volunteers, each with their own stake and purpose for being involved. Given the initiative's lack of official status, without formal organisational standing or decision-making power, the board came together but rarely, and the discussion usually revolved around the purpose and modes of delivery of Smart Oxford projects in general. Place holders for monthly board meetings were set up six months in advance, however, either due to work load or a general feeling that there wasn't anything to be discussed, these were often cancelled.

Structural and role ambiguity notwithstanding, there were also several personal limitations that shaped the output of my time in the field. As Smart Oxford did not have a permanent or even regular meeting point, I found it difficult to define my own role within the project, as playing the part of the intern turned out to be quite difficult without an office or site in which to situate myself. Ethnography and participant observation becomes increasingly challenging when the location and space one wishes to study, participate in, and observe is not only hard to identify, but without physical grounding.

Consequently, without an easily definable field site to immerse myself in to gradually build personal and professional relationships that form as a result of increased time spent together in a shared space, I found it difficult to insert myself as a recognised presence and contributor. As neither I nor my research was directly related to the volunteers' primary professional roles or departments, I only saw them on an ad hoc basis at monthly board meetings, which often did not occur. It was a challenge to try to carve out a legitimate role for myself and come across as a credible member of the project. As a yet untested participant, who had not yet managed to solidify a serious and sound standing within the group, when I began to interview various board members, perhaps I lacked the necessary gravitas to elicit more considered answers. That being said, for the presence and purpose that I was able to achieve, Smart Oxford was open and eager to share information, but only insofar as that information seemed appropriate for a student in my position. Yet it should also be acknowledged that the construction, control, and dissemination of knowledge in this way, as determined by rank and status and perhaps colloquially represented by the 'need to know' idiom, is a recognisable and much studied institutional and organisational practice when it comes to governmental structures.

Given these initial challenges, it was necessary to re-evaluate my focus and research agenda. Given that Smart Oxford alone would not provide me with enough data to adequately study smart cities, I shifted focus to the City of Oxford and the notion of multiple sociotechnical and smart imaginaries, identifying distinct groups, representing different layers of the city, from a citizen-led group, Cyclox, to a meso level organisation attempting to bring together local government bodies and grass-roots organisations, Smart Oxford. This dual-level approach shed light on how different groups, as they attempt to formalise and crystallise through their social practices and material engagement, came together and fall apart within the wider sociotechnical systems and imaginaries of the city. As such, not only was the focus on deconstructing the ideas and practices of smartness in each group, but the negotiations and networks between them were also studied to further understand how these different groups enact Oxford in their own ways, according to their own understandings of smart and their own engagement with sociotechnical and urban imaginaries. With a broader approach to the field, the emergent and unformulated nature of Smart Oxford did not pose the same problem, as I was able to engage with my other participating group, Cyclox. With this wider focus, I investigated ideas of the existence of multiple and messy ideas of smartness in one space, the role of smart initiatives, and the sociotechnical imaginaries of smart, with each element playing its role in the attempts to remake and reform that multiplicity.

From May 2018 to May 2019, I was simultaneously working with Cyclox and Smart Oxford. Throughout the duration of my fieldwork and in addition to participant observation, I conducted formal and semi-structured interviews, informal individual and group interviews, and document and policy analysis. By semi-structured interview, I am talking about a scheduled activity, where the interview is open ended, but follows a general script or interview guide, covering a list of topics (Bernard and Bernard 2012). This afforded sufficient latitude for the interviewee to suggest and follow leads of their own, allowing them to tell a story in their own words, without being hampered by having to follow a rigid line of questioning posed by myself, the interviewer. When referring to informal interviews, I mean situations that lack structure and control, making audio-recordings and in-situ notetaking more difficult (Bernard 2006). These informal interviews and meetings occurred throughout my time in the field, helping to build rapport, uncover new topics of interest, and gain a deeper understanding of the people and groups I was working with. Following these informal meetings and interviews, I would take notes about the event, noting descriptions, themes, and points of interest.

Before the first formal interview with any participant, I asked them to read and sign, if they agreed, an information and consent form. I emphasised the voluntary nature of participation, and that they could withdraw at any time. I also made it clear that the use of personal was to be as minimal as possible. However, they were also made aware that full anonymisation would not necessarily be possible, as the organisations and the positions of the individuals were common knowledge. The form also asked for permission to use direct quotes. While I didn't ask them to sign this agreement in any subsequent interviews, all interviewees signed the forms and were given their own copy. These forms were kept in a locked locker, in a secure office. In addition to this, verbal consent was repeatedly sought and given both in formal as well as informal settings.

After being in the field for approximately a year (in addition to my initial time with Smart Oxford in 2015-16), I conducted over forty formal and informal interviews, attended countless formal and informal group meetings and gatherings, I attended over fifteen board meetings and ten committee meetings, I attended social events in participants' houses and with their families, and participated as a volunteer in over ten festivals and organised events. In addition to this, I engaged in over one thousand email exchanges.

In addition to these methods of data collection, there were also textual artefacts that informed my thematic analysis. Examples of such materials are presentations, social media channels, planning applications, maps in various forms, vision statements, infographics, Government policies and white papers, pamphlets, leaflets, and many other textual artefacts informed my research and time in the field. As such, much of my data collection and subsequent analysis also involved thematic and textual analysis. When analysing these texts, I focused on perception, knowledge, sentiment, and behaviour, moving beyond counting words or phrases, and concentrating on identifying and describing both implicit and explicit common ideas and narratives within the data vis a vis text (Guest, MacQueen, and Namey 2011). By including an analysis of grey literature, I was able to uncover a more complete picture of these groups. I examined the type of information that was officially communicated to the public, to partnership organisations, and to also investigate ideas or concepts that were deliberately or unconsciously excluded. The types of questions that formed the basis for this analysis were:

- For what purpose were these documents designed?

- Do documents of the same genre cover the similar issues in similar ways?
- How do the contents of the document help to structure the relationships between affected parties?
- Are people interpreting the documents in ways intended by the authors and what are the consequences if they are not doing so? (Lee 2012)

Further, for those who write and produce these artefacts (individuals and groups alike), the processes of gathering the 'right' information and data, drafting, responding to public consultations, redrafting, and then moving on to various stages of becoming policy or official guidelines, all result from previous social and technical interactions, which in turn, influence new interaction processes and stages of becoming. These interactions and elements include both infrastructural and social elements and technical arrangements, where "civil engineering is also social engineering" (Law 1990, 175).

To manage the balance between being an active participant and full member of my chosen groups, I acknowledged and analysed, rather than ignored, my impact on the course of events, my contribution to political consultation processes, my involvement in communication practices, and my role in connecting groups and people who otherwise may not have crossed paths. While maintaining a visible (and digital) presence, I situated myself as a resource to be drawn upon, lending an extra pair of hands, an extra head, or whatever else was needed at the time. I felt it was important that I not only engage in participant observation, but that I was also observing my own participation, where I was aware of and analysed my own reactions and impact on my time in the field.

Smart Oxford

In 2015, when I first entered the field, I began working with Smart Oxford, Oxford's answer to the call of the smart city. Tangentially, much of this material was collected before my engagement with Cyclox, which is why the material is older (2015-2017). One of my first tasks was to familiarise myself with the general organisational structure and relational networks of Smart Oxford. When inquiring into the nature and structure of organisational charts, networks, and departmental relations (being interested in the correlation and/or distinction

between official and unofficial versions), responses from the board members, both from semi-structured and informal interviews, were generally vague and superficial. Interviewees tended to respond by providing the 'official party line', producing over simplified versions of the facts, providing little clarity as to the concrete workings or structure. I am inclined to believe that the generalised and sanitised responses were based on several elements. Firstly, due to the embryonic nature of the project, and lack of funding, the state and legitimacy of the initiative seemed somewhat indeterminate, giving rise to a shroud of ambiguity around the project itself, where the board members themselves may not have fully understood the nature of Smart Oxford. Secondly, the absence of any permanent or specifically allocated base of operations further compounded this indeterminacy. Consequently, most positions within the Smart Oxford initiative are filled by those who already hold fulltime employment elsewhere.

Arguably, this unofficial opt-in, volunteer commitment has both its advantages and disadvantages. Generally, there was an overall narrative that those involved really believed in the project, wanting to see it succeed, and to that end, were willing to sacrifice their own time, which is still the case three years on. On the other hand, all those involved have 'regular day jobs', which makes time a valuable but rare commodity. Inevitably, this combination of elements has resulted in, at least for the time being, a rather vague raison d'être, and a seemingly ill-defined structure contributing to a lack understanding of who does what, where, when, and for what common purpose.

As to the composition of Smart Oxford, my informants and interviewees predominantly Caucasian, socioeconomically advantaged, middle-aged, well-educated men. When I initially engaged with the Smart Oxford board in 2015, there were no women on the board, as my first board meeting was also the only woman at the time's last, and on my subsequent reengagement, out of approximately twenty members, only two were women. Given the embryonic and ad hoc nature of Smart Oxford at the time, my engagement with them tapered off over the course of the year as I began to focus more closely on Cyclox. That said, in early 2018, with the aim of studying Cyclox and Smart Oxford simultaneously, I used my previous relationship with Smart Oxford to reconnect with them with little issue. However, my focus and available time had clearly shifted, which meant re-orientating Smart Oxford within the parameters of my research.

Regardless of the fact that my engagement with Smart Oxford became more peripheral after splitting my time between them and Cyclox, I was granted access, albeit in a more restricted way. The organisations represented on the board, some with multiple representatives, are: Oxford City Council, Oxfordshire County Council, University of Oxford, Oxford Brookes University, Oxfordshire Local Enterprise Partnership, Nominet, The Oxford Trust, Lucy Zodion, The Oxford Academic Health Science Network, and the UK Atomic Energy Authority. All members were working full time, and not yet of retirement age. Most were educated to at least an undergraduate level, a few having postgraduate degrees or certificates.

In a bid to increase efficiency and provide a more solid foundation than had hitherto been achieved, Smart Oxford had secured some funding to employ a full time Programme Manager, whom I knew, and had previously worked with and interviewed between 2015-2016. While my initial engagement was ad hoc in nature, the board were very open to my participation, with very few gatekeepers guarding the inner workings, what there was of it. However, after I re-introduced and re-situated myself within the Smart Oxford initiative in 2018, my work with them was tenuous in terms of willingness to grant access. This restricted access was, in part, the result of the hiring of the Programme Manager, who felt that my presence at board meetings was unnecessary and potentially intrusive.

Initially, he seemed willing to engage, however, over the next couple of months he became less open and enthusiastic about participation and access to the board and their activities. He closed off access to the meetings, and while taking on my offer of help, he seemed reluctant to follow through. On the 30th of May 2018, at a board meeting, the newly appointed manager unveiled his plans and ideas for how to develop the initiative, announcing that he would be using the Oxford 2050 vision as a "road map", developing Smart Oxford in a way that would be consistent and complimentary to the goals and aspirations set out in the City's plans for Oxford 2050. Following this meeting, and after several subsequent informal one-to-one meetings, I was told that it would be preferable if I was not in attendance at future meetings. As it happened, in one of my follow-up meetings with a board member, I was told that the monthly meetings were to be cancelled in favour of "less frequent but hopefully, more productive meetings".

This restricted access made it difficult to observe the practices of organisation and order. However, while maintaining the carefully controlled openness, I was told that I could still contact individual board members as I saw fit, and attend meetings and events that were deemed 'relevant'. This enabled me to stay in touch with the other members, and I conducted targeted interviews, asking them to reflect upon the ways the board approaches the challenges of the urban environment, and keeping abreast of their direction, projects, and general development.

Another possible point of engagement, as suggested by the Programme Manager, was the task of researching and compiling a list and description of all the Community Action Groups in Oxford, mapping out the connections between them, and "listing them in order of importance" as well as their "potential impact" and whether or not they might oppose Smart Oxford's efforts. To maintain the relationship without directing the group's gaze toward certain community stakeholders and not others, I explained that listing these groups in order of importance and potential impact, and making a judgement call on those who would prove to be the 'barriers' to success would be ethically inappropriate.

In this way, I had to assert my neutrality and role as researcher. It was necessary to relationally distance myself to avoid being the driver of engagement and inappropriately directing his attention in regards to the local political groups. From this point, rather than working directly with the manager, he offered to act as more of a conduit through which to connect me to other people that I might have interest in. As part of this agreed access and engagement, I was able to involve myself in several Smart Oxford projects, both new and extant, telling the story of the Smart Oxford Initiative, through both active engagement and historical, retrospective investigation. Additionally, what was offered, and accepted, was for the Programme Manager to act as a go-between through which to connect me to people in his wide-ranging network that I might be interested in meeting. I used this connection to speak to people both in the City and County Councils, as part of his role was liaising with various local government stakeholders and organisations.

Cyclox

In May 2018, I began working with a citizen-led Cycling advocacy group, Cyclox, where I analysed the everyday practices and social and spatial negotiations of the city. The group's raison d'être is to campaign for better cycling conditions within Oxford and although their work is not strictly limited to the city itself, it is where the majority of their campaigning efforts are focused. My engagement consisted of participant observation, semi-structured interviews, frequent informal meetings, formal and informal group meetings, committee meetings, project engagement, and event help and attendance. Cyclox is a self-proclaimed pressure group consisting of a central committee, two sub-committees, and approximately 450 members.

As of November 2019, the Cyclox committee had sixteen members, five of whom were women. Initially, when I began working with them, only two of the committee members were women, excluding myself, one of whom was the committee administrative assistant. During my time with them, the Vice Chair come Chair championed the call to begin to redress the gender imbalance on the central committee and subcommittees. This was achieved with two new women joining the committee at the Annual General Meeting on the 20th of November 2018, making a total of five, excluding myself. Over half of the committee are retired, and the central committee is an erudite group, composed of people from various professional academic backgrounds including law, urban design, and corporate entrepreneurship, and those with more academic backgrounds mostly fell within the life sciences disciplines. The committee members, as well as those on the infrastructure and communications subcommittees (comprised of those on the central committee), are predominantly Caucasian males, past retirement age, socioeconomically advantaged, and with most having a Master's level education or higher. These sub-committees were later updated to reflect the 2019 campaigning and strategy objectives, they became the 'attractive and healthy streets' and 'safe and connected cycle networks' sub-committees.

My involvement and access to Cyclox began with my contacting the Events Coordinator, whose details I found on their website, and she pointed me in the direction of the Membership Secretary, where I was then put in contact with the Vice Chair and Chair. It was then decided that the best way to introduce myself to the group would be to volunteer for an

upcoming event (the Rose Hill Cycling Festival, 2018) where the Committee Secretary, the Vice Chair (who subsequently became Chair during my time with them), and the incumbent Chair would be in attendance (as well as some of the other committee members). From that first event, I organised several informal group meetings/interviews with the above, at the home of the Chair, to discuss how I might formalise my engagement and the touch points where I could contribute to the group, as well as gather information and data.

In subsequent meetings, it was decided that I would have four main areas of work: political consultation processes, volunteer events, website design and content improvement, and barrier mapping. These touch points involved a mix of digital communication, informal individual and group interviews, as well as strategy and action meetings, often conducted in committee members' homes, by Skype, or in the case of more formal meetings, at the Oxford City Town Hall.

The events that I attended in a volunteering capacity usually consisted of two hour shifts managed by two people manning the stall, engaging with interested parties, and signing up new members. I was present at each event, and spent the duration providing additional support, usually for up to five or six hours. From June 2018 through to December, there were fifteen events, four of them being local festivals, and eleven being organised lectures set up by Cyclox in collaboration with various partners. These lectures invited include (but were not limited to) local government representatives, charity spokespeople, local partnership cycling founders.

Throughout this process, Cyclox were open to engagement, and over time, and with familiarity, I was gradually granted increased access, such as to their shared Google drive, the closed committee mailing list, and I was present at all committee and sub-committee meetings. Not only was I granted access to the more formal proceedings of the group, I was also invited to informal meetings and gatherings in participants' homes, as well as other informal public spaces, whether they be pubs, cafes, or being out and about. Initially, the incumbent Chair wanted me to sign a non-disclosure agreement, however, over time and with the incoming Chair being elected, this was forgotten and was not followed through.

The work that I did with Cyclox was all in aid of streamlining organisational processes, putting in place structures, and helping with efficiency and administration. I worked with the

Vice Chair come Chair on restructuring and implementing their political consultation policy, which included weekly Skype calls to create a process through which to comment and consult on the local government planning and development plans and proposed policies. This work on the consultation process formed a large part of my engagement, where I set up a procedure and template that we not only used in current consultations, but that could also be passed on when my work with Cyclox was at an end. I was involved in the rebranding of their website and communication strategy, where provided a fresh set of eyes, contributed to the website layout and content, and worked on their social media strategy and engagement. I was also part of the team addressing issues of equality and access through the organisation of a barrier mapping project, where barriers to cycling were photographed and catalogued in each city ward. Finally, my time with Cyclox also included the attendance and participation in festivals in a volunteer capacity, as well as being present at committee and subcommittee meetings each month.

By way of offering this kind of support and providing an extra pair of hands to be put to work on campaigning priorities and projects, my role became that of a galvaniser, prompting committee members to action, asking questions of progress, and making plans for moving projects forward. This said, while I prompted action, I was careful to only offer supporting help and suggestions on how to move forward, but I was conscious of maintaining that supporting role, rather than become a driver or key figurehead. To maintain this balance, I was happy to provide the necessary push to move projects forward, offering to help in whatever way would be most beneficial. However, I made sure that I wasn't the one proposing new projects or priorities, creating strategies, or making any key decisions on how to make progress.

__Methodology__

The core of my empirical research was informed by an ethnographic, interpretive methodological approach, anchored in my own interpretation of the data, the interpretations of people within my field site, and my participants' interpretation of their own behaviours and understanding. This entailed examining the evolving sense making practices within the broader context of societal organisation and change. My research draws heavily on ethnographic fieldwork, participant observation, semi-structured interviews, informal interviews, and thematic and textual analysis. These methods are particularly sensitive to:

- Capturing and distilling the contextual practices of social and material networks
- How these ecosystems are (re)produced through discursive and material practices shaped by personal, social, embodied, and political relations
- How the sites in which networks are embedded matters to their form and visualisation, and
- How they perform as actants in the world, shaping knowledge and actions (Kitchin, Gleeson, and Dodge 2013)

Ethnography, as the dominant methodology within the field of anthropology, involves immersing oneself into a community to develop an understanding of the social world from an emic perspective (Ritchie et al. 2013). Ethnographic methods place interaction and interpretation of action and behaviour at the centre of sense making activity (Mason 2017). At its core, ethnography seeks a nuanced understanding of the ecosystem of a community, its social relations, its rhythms, its cultural meanings, its patterns of power and decision making, and ways of being, aiming to comprehend how these communities are constituted and how they continuously unfold. In other words, ethnographic studies provide an immersive and holistic analysis of social phenomena by describing, in detail, the many relations between multiple actors and the material world they occupy (Herbert 2000).

When in the field, Adler and Adler (1987) identify three main types of group membership: firstly, peripheral membership, where researchers participate in the group they are studying but refrain from participating in central activities, secondly, active membership, where researchers participate in all central activities but refrain from committing to the goals and values of the group, and finally, complete membership, where researchers become full and active members of the group in question. I chose to combine features of both peripheral and active membership, which required vigilance and awareness to maintain a balance and contain the level of involvement. When coding for themes and patterns in both verbal and textual exchanges, I began with questions of authorship, subject matter, and the surrounding discourse. When looking at textual artefacts, I am not only looking at authorship and content, but why the text was written, how it was written, when it was written, and its intended audience.

By investigating relationships between the social, technological, and material, I focused on the identification and recording of established and emerging relationships and practices between people, places, and things. From there, I looked at the extent to which technology and data facilitates, furthers, and transforms (or doesn't) these practices that shape and are shaped by sociotechnical structures and social institutions. These practices (such as ways of operating, decision making and wayfinding, as well as how to share knowledge, what knowledge to share, and through which networks etc.) are the patterns and processes that organise and disorganise the spaces and behaviours between people and things, constantly (re)shaping social organisation and order.

Throughout this dissertation, when speaking of practice, I speak of a focus on action as it happens, context, and presence. Understanding action as it happens provides a sense of how and why other constituent elements of the social come into being, where the implicit logics and assumptions of value, order, and organisation in those practices are made explicit (Craig and Tracy 1995). Practice as context is primarily concerned not with the individual, but with shared actions and meanings, as they are performed in social settings shaped by social institutions (Tanweer 2018). These institutions are often positioned as sets of rules of performance, where the rules themselves are often not explicit, however, the resultant practices are. In this way, practices, as they are played out in action and participation, shape and are shaped by institutions and interaction. This dynamic negotiation encompasses both human and non-human things and the constitutive relationships between them (ibid). Finally, to observe practice as action embedded in social institutions, then, requires presence, being there to see practice unfolding in real-time. This allows the researcher to participate, observe, interact, and ask questions. This, then, harnesses the empirical richness of presence, and uses observation to capitalise on the fact that "we can know more than we can tell" (Polanyi 2009, 4).

As such, and like many sociotechnical studies of the city (Guy and Karvonen 2011), I employed qualitative methods, predominantly drawing on an ethnographic approach to analyse the dynamic interaction between sociotechnical imaginaries and performances of smartness through the observation of interactions between forms of practice (ways of doing, aesthetic choices, personal idiosyncrasies, daily routines, and cultural norms), materiality (roads, buildings, technical equipment, screens, and software) and formal organisation (citizen-led groups, corporations, universities, local authorities) (Kitchin, Gleeson, and Dodge 2013).

Further, while in the field, I took on the role of an inside ethnographer, which provided a unique perspective on modes of engagement and the fluidity of social roles in the context of the city. As the boundaries between different social roles become increasingly porous and ambiguous, it is often necessary for the researcher to adopt different perspectives to be accepted in different field positions (Vernooij 2017). Insider anthropology involves full membership of the group that one is engaged in studying, and is often multi-positioned (ibid). That said, there are several methodological concerns associated with insider ethnography. One particular issue concerns the fusion of insider and outsider roles and perceptions. From the perspective of the native or active member, fundamental motives, everyday practices, and social actions run the risk of being unacknowledged or unrecognised, as they are often taken for granted by the researcher (Hayano 1979). To view the field in a critical light, the insider ethnographer must consider rather than conceal familiarity, personal connections, and contributions they make as an actor in the social processes that are being analysed (Mosse 2006).

With the blurring of the social roles adopted by the researcher, being an active member of the group in question may directly impact the publication of important insider accounts if those you work with do not agree with, or like, your interpretation (ibid). In addition to this overt outcome, there are also more subtle influences on the dynamics of power that impact behaviour in the field, and the write-up 'post' field, such as when the researcher internalises when to speak or remain silent in accordance with their perceived position within the group in question (Vernooij 2017). Further, when engaging in insider anthropology, the researcher runs the risk of failing to probe or ask questions about information that seems already too familiar (Kanuha 2000). This, however, may not necessarily be an issue, as the inherent biases or prejudices of an ethnographer studying their own group identity may also be a source of insight (Aguilar 1981). Reflexivity and a heightened awareness of one's own context and background is essential for conducting insider ethnography, paying close attention to the facts and assumptions that one leaves out of an explanation. Rather than limiting oneself with the dictatorial dichotomy of the insider/outsider boundary, the insider takes on the unique role that inhabits the space between the two perspectives (Kanuha 2000). Constantly seeking clarification for seemingly mundane actions or shared understanding of a particular event, may uncover richer and more intricate information (ibid).

There is a fine balance to be kept between being immersed in the field and keeping one's distance from it, which becomes even more critical when engaging with the familiar. In this way, the ethnographer must learn to approach the field not only with empathetic understanding, but also with the urge to continually problematise the familiar (Ybema et al. 2009). Equally, constantly distancing oneself emotionally and intellectually from the field to enhance the abstraction of models, can impede the researcher's ability to fully engage and be seen as part of the group (Kanuha 2000). Instead, researchers conducting insider ethnography have to learn to live double lives with double knowledge, teaching themselves to conduct their research with double vision (Okely 1992).

Although I did not go into the field with preconceived hypotheses, I did enter the field with a pre-assumed theoretical grounding and a commitment to the idea that smart cities are both shaped by and shape different and multiple forms of social and digital engagement, practices, and performances of sociotechnical and urban imaginaries. Over time, and through increased engagement, themes began to emerge through the constant examination of field notes, interviews, and informal conversations. These emerging themes influenced my theoretical focus, highlighting the importance of using a critical data studies lens, allowing me adjust my approach while further analysing nuances, and instrumental mobilisations, of sociotechnical imaginaries and smartness.

Chapter 3 - Smart Oxford

This chapter will introduce, examine, and analyse Smart Oxford as an organisation and examine its perceptions and mobilisations of digital data and technology. In doing so, I will explore the sociotechnical parameters that coproduce the distinct type of smartness that shapes and is shaped by Smart Oxford. This section will break down the organisational dynamics of the group, look at the relationship between funding and legitimacy, and finally, it will explore the vision of the future as imagined and propagated by Smart Oxford. Then we look at smart practices and the ideals of Smart Oxford to explore the officially endorsed 'smart city' initiative in Oxford, not only detailing and examining the group's makeup and overall dynamic but also how they imagine, mobilise, and envision data, science, and technology and its impact on present practice as well as its role in building a smarter future.

In general, while each of my case study organisations' visions and practices seemingly use the same vocabulary of access, inclusion, equality, and connectivity to convey smartness, they are conceptually homonymous, with their own meaning, set of embedded logics, and modes of engagement. Smart Oxford, demonstrating a strong affinity for individual freedom and autonomy, advocates for, and envisions, a future of competing innovations and entrepreneurially-led smart city solutions which mobilise issues of urban access and connectivity as opportunities for economic growth, while simultaneously working to 'solve' those challenges for the public good. This perspective led to the support and shaping of programs that prized performance very highly, where there is a drive to find projects and applications that would be best performing and of maximum value.

Structurally, the group operates as a loose confederate of like-minded organisations, creating an informal network connecting different stakeholder projects and programmes deemed 'smart', project's that give Oxford a competitive advantage over other smart cities, with the aim of 'solving' wicked urban problems 'first'. Rather than acting as a single organisation, their strategy focuses on facilitating connections and creating and seizing opportunities presented by 'smart' technology to address issues such as climate change, flooding, and transport and mobility. This means that their external group boundaries are weak

and porous, keeping the partner organisations together by appealing to ideas of the marketability of smart solutions and simultaneous social and economic growth.

The neoliberal smart city: Organisational attributes and dynamics

In September 2014, the Oxford Economic Growth Steering Group created the Oxford Smart City Project Board and commissioned a study on Oxford as a potential smart city. On December 11, 2014, the Smart Oxford board presented their findings to the Steering Group and the report was subsequently published in January 2015. In that original proposal, the vision, aims, and plans for "Smart Oxford: a Learning City for the 22nd Century" (Aldridge et al. 2015) were unveiled. To begin, Smart Oxford was and is managed by a board comprised of different public and private organisations across the city, and it later employed one full-time programme manager. In my interviews and follow-up interviews with each board member, I was told that the primary motivation and reason for different city stakeholders to engage with the smart city initiative was economically and growth driven, motivated by the knowledge that public and private bodies the world over are investing in smart city programmes and technologies, meaning that there was a substantial amount of support and funding to be won.

As the initial Smart Oxford report was primarily an application for financial support, its format followed that of a business proposal, laying out the benefits, goals, and objectives of the initiative, promoting a certain kind of future making agenda. From its inception, Smart Oxford was to "represent a commitment to develop efficient and effective use of data and technology for the benefit of its citizens" ('About Smart Oxford' n.d.), rebranding the city to attract and win the significant investment required to implement developments that would allow Oxford to compete for smart city resources on a global scale (Aldridge et al. 2015). When talking of the initiative as a whole, Smart Oxford uses the term 'smart' to refer to the creation of an environment and infrastructure that engages with the current digital technology movement to "support the generation and sharing of city information to facilitate the development of innovative city-related solutions more efficiently, cheaply, sustainably, fairly, and inclusively" ('About Smart Oxford' n.d.).

Along with the full report, a two-page executive summary was released, which, by examining the type of ideas and descriptions that the board chose to highlight and promote, offers some insight into the underlying motivation and worldview that shapes the programme. The summary states that Smart Oxford will:

> Stimulate innovation in Oxford's world class researchers and innovators, generate growth and jobs in private sector partners, empower citizens to identify and be part of the solution to the city's challenges, and enable public service providers to improve the quality, effectiveness and efficiency of their services.

Additionally:

> Smart Oxford will create a world-leading centre of expertise which will export proven solutions and know-how to other cities and communities . . . meet the needs of its own citizens and contribute to economic growth and prosperity in Oxford and the surrounding region.

Here, Smart Oxford's 'smart' city is a place and space where technologies and people produce innovative solutions to urban issues, where these issues become sources of opportunity and growth, contributing to the city's overall social and economic prosperity:

> The region that the City serves has both challenging environmental, transportation and housing problems, but also an enviable intellectual capacity and capability able to develop, test, and deploy smart city technologies at scale. Importantly, it has an aligned and active city stakeholder group which is committed to working together to attract investment, and already has a number of highly relevant programmes, representing a very sizable investment by a range of partners. These projects provide a firm foundation upon which to build a broader, smarter Oxford; with the initiative providing a way to accelerate the transfer of learnings from these projects to others addressing challenges facing the

city region in other areas, and secondly, providing a robust framework to enable data sharing and inter-operability.

Further demonstrating this mind set, one of the final points of conclusion in the review was that Oxford could not afford not to explore the opportunities that technology might present for it to become a better city.

In terms of social solidarity and social relations, Smart Oxford is a loosely bound group of individuals, while united by board membership and a commitment to 'smart city solutions', these individually represented organisations have their own motivations, economic priorities, and areas of interest. Broadly, Smart Oxford was not an entity that delivered its own projects, rather, it purported that it was an organisation that saw and seized opportunities of partnership between themselves and other groups and individuals involved in what the board deemed 'smart' activity, thinking of themselves as "the connective tissue that binds smart ideas and projects across the city". In a wrap-up interview at the end of my time in the field, I was told by an informant that:

> Smart Oxford helps to coordinate Oxford as a smart city, we are smart city developers, creating networks of opportunity for individuals and organisations to thrive and create innovative ideas and solutions.

To further examine the function of these connections and networks, the Smart Oxford website states that:

> Our aim is to build a stronger, safer, economically and environmentally sustainable city, to help its people to identify and be part of city solutions, to provide a testbed for world class researchers and innovators, to generate growth and jobs, to advance economic & social prosperity, and to help improve the quality, effectiveness and efficiency of city services.

These ideas and ways of viewing the world can be seen throughout visions and practices of Smart Oxford, how they conceptualise and perform smartness, the way that future ought to be shaped, and how social relations are organised within the city.

64

Exploring an individual-orientated structure, group composition, and general history

What was clear from my time with Smart Oxford was that commitment to 'the group' was weaker than the desire to select, facilitate, and strengthen individual relationships between board members who could be of particular help or could provide desired introductions to potential partners and people external to the board. In asking about the operation and organisation of Smart Oxford activities and general function, a board member told me that Smart Oxford:

> Works best when individual members take the initiative and just go out and do what they think needs to be done. The worst was when we did things as a committee, as nothing ever happened, and no one took any ownership. It works because there are people moving it forward, but not necessarily collectively.

From the beginning of my journey with Smart Oxford, my key informants on the board often stated that the group was an informal network that "connected the people who needed to be connected" and that used the board member's individual networks to present opportunities for partnerships that would otherwise not have been possible. The purported purpose of this network was to seize and generate fruitful relationships across the city, usually with those involved, directly or indirectly, in the commoditisation of technological developments.

For the majority of my time in the field, there was only the central board, with membership numbers fluctuating between 15-22 individuals. More recently, however, the programme manager proposed moving from a one to two board system, splitting the central board into a strategic board and an operational one. The strategic board was to meet quarterly, and the operational board was to meet monthly. The strategic board would be composed of senior members of the Oxford Strategic Partnership (OSP) and the Oxford Growth Board (OGB). Briefly, the OSP is a collaborative entity that brings together public, private, community, and volunteer sectors together to "guide direction for the city's future" (Oxford Strategic Partnership 2019). The OGB is a joint committee of Oxfordshire's six district councils together with key strategic partners, facilitating joint planning on economic

development, planning, and growth (Oxfordshire County Council n.d.). The strategic board is to be convened by a new chair, and in board discussions on who this chair should be, members agreed that it should be someone with "a big name, an expert who will lend credibility, and bring authority". Parenthetically, by the time I exited the field, that person had not been decided upon or appointed.

The role of the strategic board was to make high level decisions, set top-down direction, and to provide guidance to the operational board. In the programme manager's presentation to the board in which these ideas and changes were presented, the responsibilities of the board were as follows, to:

> Promote and market Smart Oxford to secure inward investment, encourage Oxford groups to engage, contribute to knowledge development, to make Smart Oxford a key influencer, continue making connections and networking, identify and match complimentary groups, advise city leaders, tend to group relationships, and to fit to global, national, and local strategic overviews.

In the same presentation that proposed the dual system, it was explained by the manager that the operational board, unlike the strategic board, were to be representatives of all those who were operationally engaged with Smart Oxford. Their role was to "make operational decisions with a focus on local contexts, handle project management and reporting, and get feedback for 'bottom up' direction setting to the strategic board". It was further stipulated that those on the operational board "must commit to provide resources and road-mapped smart Oxford projects". The presentation and subsequent discussion, however, seemed less about civic participation and engagement, and more about influencing decision makers and about the impact of Smart Oxford as a smart city, wanting national, if not global, recognition, and driving investment and growth.

Much like the current plans to appoint an 'expert' as the chair of the strategic board, in the early stages of Smart Oxford's development, an informant told me that a "veteran smart city enabler", with experience in smart city initiatives in Berkeley and Paris, was installed as the director of the board. They were approached to steer and mould the initiative based on the

success of their previous engagement with the smart city concept and the implementation of 'smart' projects and programmes between Berkley, CA and Paris. However, one of the original board members said that despite his "successful track record", there were issues with this veteran's leadership style and general approach. These issues, I was told by a key informant, could be boiled down to "personality clashes with other board members". Another informant said that the chair was "not prepared to listen or field questions without feeling personally criticised. S/he rewrote reports and proposals when s/he felt that those tasked with writing them weren't capable enough. Their way of leading was far more authoritarian".

Initially, this Board Director was hesitant to involve Oxford University, and academia in general, preferring to take the lead in writing the reports, plans, and objectives themselves. Given their more authoritarian management style (resulting in the unintended exclusion of others), alleged reluctance to take criticism or collaborate on ideas, leading to conflict, they later resigned the position. Subsequently, the Board decided to forgo the installation of a new director, instead, preferring to adopt a less hierarchical, more horizontal organisation structure. This approach, however, has not been without its drawbacks, the main shortcoming being a lack of structure, with some members trying to move the project forward, but not necessarily in unison, or even in the same direction. Consequently, there is a type of benign neglect being fostered, a lack of communication and information sharing, leading to each member only having partial knowledge of what the other members are doing or the avenues and projects they might be pursuing.

To get information directly from the source, I tracked down the original director on LinkedIn and requested to meet. In two interviews that resulted, I met with the former head of Smart Oxford who, contrary to my expectations (based on my discussions with other board members), seemed amiable and affable. However, they also admitted to having a very 'strong' opinions and personality, and that it "pissed some of the board members off". In a very matter of fact manner, they said they were "the only one who took the lead, there was no one who would step up and take responsibility of the whole, and there's a point where you have to walk away when you know something isn't going to succeed". When pressed further, they said that there "was simply no buy-in, not from politicians, businesses, or people, and without that, without the buy-in, without backing, without money, it won't go anywhere". With that being

the case, they decided to walk away and leave Oxford's smartness in the hands of the remaining board members.

For profit: Funding and resources

This issue of money and backing was present throughout my engagement, it shaped and motivated how Smart Oxford formed and maintained social relations, and it informed the types of social connections that were sought after. At almost every board meeting the issue of funding was brought up, where, without money, the board felt that they had no power, no authority, and no way to really elevate Oxford as a smart city. Across these meetings, when discussing questions of 'what Smart Oxford did, what its remit was, and how it could get things done' one member clearly and repeatedly stated that "it always comes back to money", or lack thereof. While there were small bids and investments made over my years with Smart Oxford, these amounts were not 'substantial', at least insofar as urban development investments were concerned and the millions of pounds up for grabs in terms of smart city development. This was one of the reasons that Smart Oxford developed as the "connective tissue" of the city, connecting people who already had funding and support rather than producing standalone or flagship projects. Even though Smart Oxford did not, in my time with them, receive the funding they were hoping for, substantial backing and buy-in had always been viewed as essential and securing investment was a mark of legitimation and a measure of success, as illustrated by the following excerpt from the executive summary of the original 'Smart Oxford report':

> Funding from government can take us some way, but we need to secure inward investment from the business world too. . .
>
> To launch, promote and market 'Smart Oxford - the Learning City' . . . would initially be built upon all the investments that have already taken place in Oxford that relate to the city thinking more cleverly about itself and how it does things. This, and the messaging associated with it, will create a 'buzz' and will start to attract partners . . .
>
> Smart Oxford will develop a detailed strategy and business plan, bearing in mind that the rest of the world is not going to wait for Oxford . . . partner

organisations must be opportunistic and make sure that they submit bids relevant to this ambition. The Strategy and business plan would pull together key project teams, identify partners and funders and drive forward the winning of additional funding.

Further, in terms of how Smart Oxford selects which projects and partners to connect and support, how they weigh the benefits of partnerships and general social relationships, and how they measure the success of initiative, an informant told me that it was just a matter of "doing a cost-benefit analysis, where even the social aspect can be thought of in terms of cost-benefit". This meant that relationships and connections, internal and external, were initiated and maintained by this type of 'cost-benefit' equation, where the focus was more on the outcomes than process, and where maximum value extraction was key. This individualistic, entrepreneurial way of organising social relations and priorities can further be seen in the role description and desirable criteria as set out in the job application for the Smart Oxford programme manager. The first stated 'main purpose' of the role was to "lead engagement with businesses and organisations to support Smart city related enterprises across the city and county", further stating that the manager was to coordinate "support services to innovators and enterprises helping to develop and deliver projects and products that support Smart Oxford". Under desirable candidate criteria, the first two points were "fundraising experience and experience of marketing and promotional work", all in aid of facilitating, securing, and delivering successful smart projects, raising Smart Oxford's profile, and creating an urban ecosystem that facilitates economic growth and development, which is uncritically assumed to contribute to the social good.

The idea of developing and selling smartness as a means to survive and thrive was at the very heart of Smart Oxford's agenda. The generation and accumulation of capital to further the Smart Oxford cause underpinned every thought, action, and partnership. While the 'social good' and 'wellbeing' was discursively woven into the proverbial heart of Smart Oxford's programme, without money, it was thought impossible to achieve and maintain. This way of thinking reflected and was reinforced by the corporate management style of Smart Oxford, further facilitated by the programme manager's background in corporate technology, with a history in business development with Cisco. Thus, there is an increasing tendency to adopt corporate strategies and business-like processes in order to out-compete other cities for

resources. While this corporatisation isn't a new strategy for Smart Oxford, since the programme manager took over officially, it has become more overt.

To illustrate this point, immediately after their appointment, in the programme manager's first presentation of Smart Oxford's direction to the board, the targeted activity of the group was to "define, build, and run specific projects sponsored by tech companies to match Smart Oxford priorities . . . and provide quick wins to engage and energise communities". Additionally, another priority of Smart Oxford (to be achieved by the end of March 2020, prior to the COVID pandemic) was to build and run a "smart city co-working space, to provide innovation support to smart city start-ups and projects, building 5 – 10 successful start-ups" and to "sign up 2 – 5 key corporate sponsors". This way of commoditising social relations and networks demonstrates the comparatively more business-like and managerial worldview of Smart Oxford, where competition and individual innovation and achievement are supposed to facilitate a balanced and prosperous society, where groups are more likely to be a collection of individual entrepreneurial types, where resources, knowledge, and now data, is bought and sold, and where everything is fluid and up for negotiation.

Overall, as discussed in the literature review, much of the early work on smart cities focuses on and criticises the blatant neoliberal undertones of commercial and real-world smart city applications. More recently, there has been a call to study the impact of smart agendas on citizens 'on the ground', as it were. Smart Oxford, with its shift to 'wellbeing' as its rallying cry has made the discursive shift to a more humanising smart city agenda, however, on the ground, as this research has shown, in this case, things are still dominated by a neoliberal mentality and far messier and less straight forward in smart city practice than in smart city planning and imagining.

Citizen-centric rhetoric vs corporatisation

Smart Oxford's discursive focus on 'citizen-centric' smart solutions, advocating for civic engagement and participation, is focused in such a way so as to paint the picture of Oxford as a place where anyone can bring any smart idea to life in a living lab, where everyone has access to resources and services, where technology drives and facilitates social change and

wellbeing. This is clearly demonstrated in the summary report of the original Smart Oxford proposal written in 2015:

> The Vision of Smart Oxford will be a city where innovative ideas, active citizens, and aligned stakeholders come together to build a city that develops, evaluates and deploys new technologies and methods . . .
>
> To achieve this vision, the city's citizens and stakeholders will collectively exploit the opportunities arising from data-sharing and smart city technologies.

The overarching vision of Smart Oxford is one where "innovative ideas, active citizens, and aligned stakeholders come together to co-create a better Oxford" ('About Smart Oxford' n.d.). The future is envisioned as a place where technologies and people collaborate and coordinate their efforts and resources to build a city that develops, deploys, and embeds new technologies into the urban environment to "enhance understanding of itself as a living, breathing community, and achieve understanding and consensus on how it should change to become equitable, sustainable, prosperous, and resilient" (Aldridge et al. 2015, 3). This vision is underpinned by respect for personal freedom and autonomy, where innovators and citizen scientists are encouraged to develop ideas that not only contribute to the public good but are developed with the intention of selling that solution to other smart cities.

In Smart Oxford's case, the quest for smartness and the resulting relationship between digital data, technology, people, and the city shapes and is shaped by the idea that the city is monetisable and that competition and entrepreneurial endeavours facilitate processes which tap into the resources of the urban landscape and its many afforded opportunities. As such, from Smart Oxford's point of view, when considering the concept of urban competition and strategy, to encourage growth and economic development, a city needs to position itself in such a way so as to attract investment while simultaneously attending to its civic obligations to its citizens. As a result, Smart Oxford's 'people centred' approach tends to focus on citizens as potential data points, users, and consumers.

An example of the above can be seen in a presentation by a board member on 'building smart cities from the ground up', where one of their final comments was to "think of the citizen as a consumer and lower the barriers to entry for becoming a smart citizen at all points, or even provide incentives to help them build the data mountain . . . and new technologies will help break some of these barriers down". In this way, people-centred innovation and the relationship between data, people, and Smart Oxford focuses on supporting innovators by proposing and building the previously mentioned living lab facilities and conditions, where savvy individuals can ostensibly take advantage of the urban setting to test and prototype solutions in a near-real-time setting, with the ultimate goal of producing a commoditisable and social beneficial product that can be scaled up and sold to other smart cities. This can again be seen in Smart Oxford's bid for the title of 'European Capital of Innovation' where the document states that the citizen-centric approach being adopted includes "extending access to social enterprise and social innovation, inspiring and attracting new generations of science and technology talent and businesses, and pioneering smart city and healthcare solutions by embedding innovations in the ecosystem", where the focus is on creating an environment where individuals take advantage of Oxford's urban settings and circumstances to innovate and create technologically enabled solutions to urban issues.

This illustrates the type of competitive and individualistic institutional sociotechnical smartness that underpins Smart Oxford's worldview, public discourse, and practice in relation to technology and data. For example, throughout my time with Smart Oxford, the bids and grants that were applied for, and the competitive nature of these grants, served to reinforce and shape ideas and arguments that support the value of competition and marketability, as cities 'win' or 'lose' these bids, making the city 'better' or 'worse', and facilitating the creation of 'smart city' rankings and league tables. This further illustrates the idea that entrepreneurial innovation and drive are seen as the best and most logical ways to stimulate growth and attract investment while addressing social issues in a system that maximally benefits society through competition and individual ingenuity. In this way, Smart Oxford appeals to ideas of individual gain and opportunity to motivate innovation in relation to data, digital technology, and smartness.

In a presentation given by the Smart Oxford programme manager to the board, a smart city was explicitly defined as "a municipality that uses information and communication

technologies to increase operational efficiency, share information with the public, and improve both the quality of government services and citizen welfare". From its inception, Smart Oxford was to "represent a commitment to develop efficient and effective use of data and technology for the benefit of its citizens" ('About Smart Oxford' n.d.), rebranding the city to attract and win the significant investment required to implement developments that would allow Oxford to compete for smart city resources on a global scale (Aldridge et al. 2015). Like many smart city visions, the rhetoric of being 'citizen centric' is heavily drawn upon, and there is an explicitly stated focus on citizen empowerment, advocating strategies that increase civic involvement and participation. Yet, in the search for sustainable economic growth and a higher quality of life, Smart Oxford, like many of these types citizen focused smart cities (Thomas et al. 2016), conceptualises 'citizens' and urban challenges as sources and enablers of economic growth.

In a bid to address this conceptualisation and differentiate Oxford's type of 'smartness', thereby attracting more investors, I was told by the programme manager that the initiative was to be rebranded to focus on 'wellbeing'. This particular idea and vision of wellbeing and citizen centrism was one where all individuals would be free to innovate and access resources to aid in the development of 'smart' solutions to Oxford's urban issues. This demonstrates the deeply embedded values of autonomy and freedom, where the idea is to create a world where people, as well as public and private entities, are free to exploit all opportunities, and where a 'smart' ecosystem facilitates that exploitation. This focus is on individual's innovating to solve social and environmental issues, rather than the responsibility of social and environmental wellbeing falling on the more powerful urban stakeholders who feel that it is their duty to uplift the marginalised and disadvantaged.

As part of this 'wellbeing' repackaging, a choice was made to move away from the branding of Smart Oxford as 'Smart Oxford: A Learning City' to 'Smart Oxford: learning, caring, thriving'. When asked about this change, and why those words in particular, I was told that it was in an effort to expand beyond just being a 'learning' city, and to incorporate a 'caring' perspective, and using 'thriving' as a positive word for growth, meant not just economically but socially as well. However, the underlying idea of 'learning' was still to inform the vision and mission of the group, where Oxford as a learning city, with Smart Oxford's assistance, would have "the ability to better understand and influence how the city

functions, exploiting emerging data flows, which critically depends on smart city technologies and processes".

Smart Oxford anchored their vision in a drive for economic growth and the securement of private investment. By way of example, I was told of a series of five workshops to be run throughout 2019, entitled SMEs and Start-ups: Unlock Oxford's smart solutions. The tagline asks "what could your company create if they harnessed the power of technology and all the data in the city?" These workshops were to target businesses and citizens with innovative ideas for apps and smart technological solutions to social issues, where the objective is to develop a coordinated group of "smart city solution developers, SMEs, and start-ups, with the primary mission to deliver smart city solutions for Oxford, initially, and then to sell to other smart cities worldwide". That said, to adhere to the new vision focus on 'wellness', I was also told that the prerequisite for Smart Oxford support after these workshops is that these commoditisable 'solutions' need to benefit society in some way, making the city more accessible (digitally or physically).

Thus, respect for the individual is enshrined through competition and self-regulation and they are further conceptualised and mobilised as sources for economic growth and sustainability, where innovations, social or technological, attract investment to enable the enactment of a particular type of smartness. However, that is not to say that these innovations will not contribute toward the reduction of poverty, or greater access to information and public services. Indeed, Smart Oxford's new focus on wellbeing is an attempt to focus on "people and inequality", but it is to say that those contributions are also based on performance and the maximal extraction of value. So, it remains that, for Smart Oxford's notion of smartness, the idea of being smart focuses on technologically enabled solutions developed by individual citizens and independent organisations to address social issues, mobility, access, and connectivity.

The manner in which this 'smarter' city was to be brought about was through the establishment of Oxford as a living lab. While the creation of Oxford as a living lab was a goal shared by the councils, here, a central pillar of Smart Oxford's reasoning was that this lab would provide ordinary citizens with access to funding, expertise, and research to develop new ideas and solutions to solve the city's problems. As explained by another of the programme

manager's presentations for potential investors and innovators, the rationale behind Oxford as a living lab was that it creates an environment that enables the exploration of "technology-enabled solutions [and] the convergences between technologies to create new products and services . . . and co-creating solutions through public-private-people partnerships".

Further, and again drawing on citizen-centric discourse, the presentation stated that these solutions would be "people-focused and integrated into communities to enhance quality of life and liveability. People will be at the centre of the design and testing processes" (ibid). Again, while there is the focus on developing solutions that are people-focused, these solutions also need to have a strong business case, with an underlying 'bottom-line' mentality driving the investment in Oxford as a living lab to enable the city to survive and thrive.

The creation of the living lab is not only seen as a logical way forward, but as the right thing to do because, as an informant said, it "draws on ideas of digital and social connectivity, linking digital solutions to real world scenarios and communities, provides citizens with opportunities, and highlights possible areas of synergy and development for the benefit of the city". To bring this to life, Smart Oxford is working towards the creation of a shared working space, a "Central Observatory" from which to conduct experiments and analysis of the feasibility of projects and partnerships spawned by the living lab. This space is designed to be open and accessible for any citizen with a potentially smart solution to be developed, tested, and commoditised. This further illustrates a strong commitment to upholding the rights of the individuals and anyone (including corporations and government departments) with an idea that will take full advantage of all opportunities presented by technological development to address urban problems, appealing to ideas of efficiency and self-interest to drive innovation for the betterment of society.

Here, experimentation is seen as logical, where failure provides the opportunity to learn and grow and where performance is valued and maximised. It is also worth noting that the 'living lab' that is to stimulate Oxford's smart city is assumed to be one where the solutions and experiments are technologically based, in all my conversations with board members and the programme manager, it was taken for granted that the lab was a place for digital innovation and experimentation, a data-filled space where other forms of non-technological experimentation were not discussed, or seemingly, even thought about.

Technocentrism: Smart Oxford's perceptions and mobilisations of digital data and technology

For smart Oxford, technology is seen as an 'answer' to the ails of the city, and those solutions will be most effectively and efficiently generated in an individualistic and entrepreneurially led society, where being smart depends on being technologically and economically enabled, using the idea of the city as a living lab for the development commoditisable products and services that address urban issues. Here, it is considered natural to experiment, where solutions can be tested quickly and effectively, and where failure is seen as an opportunity to learn, grow, and improve. Reflecting this, Smart Oxford tended to favour those who have ideas and 'solutions' that are scalable and, ultimately, sellable. As such, digital data and the digitally mediated city is a space for experimentation, personal freedom, opportunity, and success for those ideas that outperform the rest.

Technological fixes to wicked problems

The main narrative and justification for Smart Oxford's activities is firmly based in the unquestioned benefits of disruptive innovation and a faith in technological change and technological fixes as a means for achieving sustainable social and economic growth and development. This reflects a worldview that fosters individualistic and competitive forms of social solidarity, embedded in justifications and public appeals to self-interest, competition, and autonomy that the drive Smart Oxford to enact a type of smartness that seeks to exploit every available opportunity provided by the digital age. These arguments, in turn, shape the dominant worldview, form of social solidarity, and ideas and practices of smartness displayed by Smart Oxford.

As previously discussed, Oxford, like any other city, contends with the wicked problems that are plaguing urban spaces the world over, be it climate change, urban planning, or resource management. Unsurprisingly, Smart Oxford's approach to wicked urban problems is one where digital technology and data are used to create and maintain an urban ecosystem where citizen scientists and innovators are encouraged to develop, test, and deploy their own

ideas and projects to tackle problems such as air pollution, congestion, flooding, and inequality. Oxford was consistently described by board members as:

> The perfect place for innovators and companies to test their concepts and products because even though Oxford is a relatively small city, we have all the environmental and social problems of a large one, so it's a great place to test for scalable solutions to urban problems that can then be sold to other smart cities.

In a workshop hosted by the board on 'the discovery of Smart Oxford', one of the key arguments made for why people and companies should engage with the initiatives was that there is "no barrier to entry, whoever you are, whatever size company you have, if you're innovating, if you're solving social issues or addressing climate change, then we're interested . . . there's money to be made . . . We're not just learning to solve our own problems, our solutions will work in other cities".

What became clear from my time in the field was Smart Oxford's faith in technological development and 'digital fixes' for wicked urban problems was persistent, unquestioned, and unwavering. Smart Oxford's focus was, as I was told by the programme manager, "people centred and citizen-centric", but it was the technology developed by and for those people that were the means to the end. In a board meeting convened to discuss 'what Smart Oxford becomes next', the summary document subsequently circulated stated the following:

> Innovative technology provides the building blocks of a smart city, but *change is brought about by and for human beings*. So we want to make space for people from every part of Oxfordshire to imagine, collaborate, design and create. We're also determined to learn from expert thinking and research, making sure the developments we encourage and bring to life will genuinely improve people's everyday lives (original emphasis).

Further demonstrating their faith in technological change and its central role in urban survival, in the internally circulated 'Smart Oxford discovery' workshop notes, one of the reasons for the existence of Smart Oxford was that they wanted "to be part of the

[technological] disruption happening in cities across the globe – changing the way we live and work, showing people the way forward in a changing world. If we don't do this then inequality increases, air quality decreases, job rates fall, and economic prosperity suffers". Not only that, but it was assumed that once technology had stepped in, once a project was up and running, once the app or programme was established, it would continue to function as it should without further interference. Once a project was seen as a 'success', it was left alone and when other products and solutions came along, they would naturally supersede those before them.

When speaking of issues such as air pollution, congestion, and mobility, sensor systems, autonomous vehicles, and traffic mapping apps are assumed the only 'logical' ways forward and there were never any significant or robust alternatives offered, or seemingly even thought about. Additionally, with regards to the reduction of Oxford's carbon footprint, Smart Oxford believed that the city's energy infrastructure needed to increasingly prioritise and support the charging of electric vehicles, not only to accommodate growing demand, but to address various aspects of climate change in, according to them, the most effective and efficient way. This argument was further supported and justified by the prediction that electric vehicles are expected to be "35% of global car sales by 2035", as stated in a document written by Smart Oxford on 'preparing for the future'.

What was also apparent from my time in the field was a reliance on expert knowledge and research to support the above ideas and smartness in general, which was thought to lend weight and credence to overall social and economic justifications for the type of 'smart' city as envisioned by Smart Oxford. Not only that, but as reflected in the programme manager's presentation on the current and future direct of Smart Oxford, there was a clear drive to recruit "senior national and international experts in smart cities, tech and non-tech, and from the public and private sectors" for the board as well as for general collaboration. Further, it was explicitly noted that Oxford, as a smart city, will "be underpinned by academic and technology innovation expertise" (sic). This shows an underlying assumption that urban issues can be treated through efficient, analytical, and 'smart' applications, that it is man and innovation, not a return to nature which can best address these problems. Here, economic growth and investment in technology are seen as vital parts of the solution to climate change and urban planning.

For Smart Oxford, those who don't embrace the potential of smart technology to solve climate change and inequality, or those policies where there is not enough of a focus on investing and embedding 'smart' technology, are seen to place Oxford at a severe social and economic disadvantage in the world of smart city advancement. Arguments and proposals that impede or ignore the uptake of smart technology and the 'disruptive step change' that Smart Oxford sees as an inevitable and global movement, as well as projects and groups that do not fully exploit the opportunities presented by this step change, are seen as counterproductive and imprudent. Thus, to face climate change and issues such as congestion, flooding, and access and connectivity head on, Smart Oxford sees one of its goals as the imbedding of smart technology into these plans and policies. Regarding urban access and connection, addressing issues of urban planning and connectivity, in Oxford's response to the City Council's draft Local Plan 2016-2036 policy, it stated:

> By 2036 we should not only have 5G but also gone through a 6G mobile transition as well. It is not clear at this time what 5G is, let alone 6G. However, we do know it will utilize much higher parts of the spectrum than previous mobile telecoms generations. These high frequencies and bandwidth sizes are capable of transferring very large amounts of data . . . The key issue for the telecoms companies to enable 5G (and likely 6G), will be to be able to put in this high-density infrastructure in a cost efficient manner.

Here, urban planning and providing equal access to a digitally mediated city and cross-city connectivity now and in the future is couched in terms of cost efficiency and technological innovation. What this shows is Smart Oxford's perception that market forces and technology should be free to operate and innovate in a manner that protects autonomy and works with the smart city market. In an internally circulated document, shared around by members of the board, the 'Smart Oxford discovery notes' which summarise a workshop on Smart Oxford's future stated, with obvious humour, "we need to make sure that in 800 years we're still considered a resilient, sustainable, smart, and innovative city. We think the city is f**ked if we don't do this! If we don't pursue this [technological step change], we'll grind to a halt". As such, those who don't exploit these opportunities placed in the role of the antagonist or the 'simply misguided'.

Future-proofing: Being 'smart city' ready

Smart Oxford's vision of the future, their ideas and practices of smartness, and their relationship to data heralds digitisation and technological innovation as not only inevitably ubiquitous, but as a key source of economic and social growth and sustainability as well as a way to address wicked urban issues, as discussed above. Throughout my time with them, and in much of the Smart Oxford literature, being 'smart' meant engaging, and even getting ahead of, the "current step change in digital technologies" ('About Smart Oxford' n.d.). This 'step change' is a concept that refers to a change of paradigm/platform regarding sociotechnical structures and digital communication. An internally circulated document on the role and purpose of a 'smart city' suggested that those cities that are engaging with this step change are "often called 'smart cities', and their digital and communications infrastructure supports smart solutions…creating efficiencies and promoting city prosperity and resilience via innovation digital solutions" (Smart Oxford 2016, 1). These cities are those that unquestionably and relentlessly chase 'smartness' and committed to the idea that everything can be smart.

To further explore Smart Oxford's notions of, and the focus, on data points and the type of sociotechnical imaginary that shapes and is shaped by Smart Oxford's notions of smartness, I look to an internal document circulated by Smart Oxford entitled Future-proofing for Smart City Developments in response to one of the main City Council planning policies for Oxford. The five-page feedback document discusses the need to embed 'technology future-proofing' into urban life and infrastructure. In this vision of smart, cities can only call themselves smart when "digital and communications infrastructures generate innovative digital solutions such as smart buildings, integrated transport systems, smart energy grids, and information sharing across city services". This technological future-proofing refers to a general directive for developers and policy makers to ensure that projects and policies are 'smart city ready', and identify "possible smart solutions in their broadest sense, at an early stage".

The document further stipulated that the City Council should incorporate measures that support a clear commitment to an open, city wide data sharing process and that development projects should be designed to generate "as much useful data as possible, and in a useable form", here, a 'useable form' refers to one that is machine readable. What this shows is the underlying assumption that 'usability' and access to information in and about the city is

understood to be maximally effective when facilitated through technological development and urban digital mediation. In addition to the required and desired use of 'smart' data, there is a focus on the "new technologies" through which to gather this information, which is meant to "help provide a long term sustainable future for the city…as future prosperity is likely to depend on [the city] being an engine for innovation".

The type of thinking that this document alludes to supports the idea that to be 'future-proof', one must not only be technologically enabled but also institutionally capable of taking advantage of that technology. Here, the future is uncritically assumed to be technological and that to survive and thrive, Oxford needs to seek and maintain a competitive advantage to ensure that survival. This also highlights the underlying and driving notion that the city is a resource that can be commoditised and where competition is one of the most efficient ways to harness and benefit from that resource.

The idea of a technologically enabled, monetisable, and competitive city can also be seen in theme of 'exploitation' that ran through Smart Oxford literature and rhetoric. In the 2015 Smart Oxford proposal report, there is a clear emphasis on the need for the city's citizens, stakeholders, and sponsors to work together to "collectively exploit opportunities arising from smart city technologies" and engagement with the ICT industry (Smart Oxford, 2015:3, 5, 7, 8, 27, 31—and the 'exploitation' continues). Similarly, in the future-proofing document it was stated that the city's infrastructure needs to be well-equipped to "help collect and exploit data to the full" (2016, 3). The report further suggests that infrastructure planning processes be encouraged to take advantage of opportunities to "incorporate and fully exploit smart city aspects", with a call to the City Council to set design criteria to include 'smart technology'. Further, the board felt that current and future ICT infrastructure should maximise asset reuse, stating that "in the age of cloud computing…data is the primary asset, not physical infrastructure".

In the programme manager's 'where is Smart Oxford heading' presentation to the board, they said that part of the "core infrastructure of a smart city is a device connectivity network and an open data platform", where the purpose of the network is to "interconnect all sensor and control devices". Further, the platform is to "store data sets that businesses, academics, and the public can use to develop solutions" and can provide information so that

Smart Oxford "can show data points on a map to help explain issues to the public". This idea of opening up and using the city's data to visualise and break down issues into comprehensive elements for public consumption demonstrates Smart Oxford's tendency to view urban issues as opportunities that can best be solved by fostering an environment of individual competition in which the best and most innovative solutions will take that data and 'solve' the city's problems.

To that end, an early event that Smart Oxford and Nominet, a company represented on the board, organised was the 'Smart Oxford Challenge' which was headlined as a "start-up accelerator to help fledgling entrepreneurs create compelling smart city and IoT innovations for the city of Oxford and beyond" (Smart Oxford 2015). Smart Oxford's goal was to gather individuals working on a range of ideas and select the most innovative project through a competition, where the project with the most potential to benefit Oxford and other cities "with smart thinking" (ibid) would emerge victorious. A follow up blog written by the Nominet board member stated that "smart cities should really be about deploying technologies to solve real problems that matter to people, not just deploying technology for collecting or analysing data for the sake of it". Later, I was told by an informant that "data sits alone and isn't worth anything if it's not used properly", here, the underlying idea was that data and digital technology are vehicles and the data is only of use if the value is extracted and mobilised by individuals to produce innovative and 'smart' concepts and projects.

This idea and relationship that Smart Oxford cultivates between 'smart' technology, people, and commoditisation remains at the forefront of the group's direction and strategy, as can be seen in the 2019 workshops being held for SMEs and start-ups that I previously mentioned. In discussing the plan for these workshops with the programme manager, the idea was to gather and coordinate a group of "smart city solution makers", where the series is designed to take SMEs/start-ups through learning and development processes that will teach them to:

- Learn what target audiences/customers (citizens, communities and local businesses) want
- Identify and engage with supportive and IP-holding resources (technical colleges, universities, research establishments etc.)

- Finance and take their solutions (products/services) to market (products/services) (Smart Oxford Café Sci presentation, 2019:10)

Speaking to the programme manager, they stated that the overarching objective of these workshops was to "develop a coordinated group of smart city solution developers, SMEs and start-ups, with primary mission to deliver smart city solutions for the Oxford city region initially, then sell to other smart cities worldwide". Additional takeaways for those in attendance included learning "how to build technology based solutions, which will enable your business to develop sustainable systems and 'smart' (technology based) solutions . . . capitalising on innovative technology solutions and harnessing all available data". Thus, this shows us that the persisting idea and performance of Smart Oxford's smart city is one that emphasises independently developed technologically that facilitates the digital enhancement of services and civic engagement to address urban issues, using the city and its stresses and strains as a testbed for products and services that need a 'smart living space' to see how concepts play out and show near-real-time innovation.

In an interview with the board's self-proclaimed, but unofficial, 'digital research and collaboration officer', who worked for Oxford University, they said that being a smart city is all about being a "first mover and early adopter", where the competitive advantage and general value lies in originality, in innovation, and in the ability for people with 'smart ideas' to be in an environment that allows them to develop those ideas and help Oxford "get ahead of the smart city game". In this same exchange, they said that "a city is only smart if it does things in clever ways before anyone else. Once everyone does it, it's not smart. If you're not on the cutting edge of research and innovation, you've failed at being smart. Once 'new tech' is the norm, it's no longer smart". This illustrates Smart Oxford's drive for smartness through innovation and marketability, in that, to be successful, "you have to be ahead of the best, and then you can work with the best, while finding solutions to things like inequality and standards of living".

'Smart' attributes and smarter transport

Recently, I was told by an early supporter and board member that Smart Oxford, and smartness in general, is about has three key aspects; connection, timeliness, and digital

communications. In this context, they said that connection is both digital and social, where Smart Oxford:

> Draws a digital frame around Oxford, identifying and supporting smart ideas and projects, looking for projects that are smart, whether they know it or not, apps and tech projects started by individuals or companies. Once it's connected, it becomes part of the connection.

Timeliness refers of a notion of smartness as innovative and novel, but fleeting, demonstrating that Smart Oxford tends to put pressure on the use of time as part of its commitment to efficiency and smartness. Finally, digital communication raises awareness of the 'smart' things already going on in Oxford, using traditional media and digital platforms to build Smart Oxford's profile, and consequently, their understanding of smartness. For example, the hashtag '#StartedinOxford' has been used by the board to label and ring fence projects they consider smart, fostering the idea that Oxford has always been 'smart' and now they are simply connecting and communicating 'smart' ideas through digital platforms and promoting technological smartness, extending access to a wider audience base to foster continued innovation and promote individual projects and concepts.

Over the course of my fieldwork, the programme manager and I spoke regularly and generally of the type of smart city projects and concepts that are promoted the world over, where they singled out the deployment of technology in the field of transport and mobility as a key aspect of smart city programmes, focusing on connected driverless car networks and systems, sensing traffic systems and access to those systems, and electric vehicles. Attending a smart city conference in London with one of the board members, I was told that that smart transport "data needs to be accessible in a consumable and interoperable way to enable people to take charge of situations and make more informed decisions about their lives". In line with this goal and way of thinking, another board member stated that smart transport in Oxford is one of the main pillars of the initiative.

I was further informed that these transport solutions were already a 'success' in Oxford, with smart parking apps and multimodal journey planners being widely available (whether or not they were being used wasn't mentioned), connected and autonomous vehicle projects "up

and running", electric vehicles and the support thereof being "well under way", and that all of these projects and networks were 'highly' data driven. These so-called smart relationships between data, technology, and urban infrastructure demonstrate Smart Oxford's notion of 'access' and connectivity' and its alignment with the group's predominantly individualistic worldview and form of social order and organisation. For example, in an event, 'Lord of the Ring roads', hosted by a Smart Oxford board member in conjunction with the Oxford and Technology Media Network event, the stated aim was to facilitate and connect people and organisations to reveal investment opportunities, and driverless futures occupied the prime position. The Eventbrite summary included the following:

> The promise of the driverless car has been the dream of generations. Today's urban congestion combined with a highly mobile population has made the proposition even more compelling. The big question is - does the development of autonomous drone technology and artificial intelligence make the dream now possible.

An example of this type of smart, mobility focused project was 'MobOx' which frequently featured in discussions of 'successful' Smart Oxford outputs, especially in terms of smart transport solutions. MobOx is a community interest company, commoditising the latest technological developments to develop Oxford as a living lab for mobility, to "assess, validate, and prove the business cases of a variety of innovative transport solutions . . . [to create a] truly integrated transport system" (MobOx 2017). As described on the Smart Oxford website, MobOx seeks to understand challenges of mobility by analysing local data on transport and movement in and around the city. Their aim is to improve living, create economic opportunity, and build a closer community through utilising "the power of data, networks, and communication technologies" ('About MobOx' 2014). At the core of this project is the drive to "integrate the experience of the city user", and almost from the beginning of the Smart Oxford project, I was told by numerous board members that "MobOx is Smart Oxford". As such, Smart Oxford actors often pointed to MobOx as a shining example of smart transport solutions to urban challenges, where technological connectivity links autonomous vehicle networks, and provides near-real-time traffic and multimodal transport information directly to residents, which gives greater access to the city's digital infrastructure.

Further, working toward an intelligent mobility ecosystem, MobOx and Smart Oxford mobilise the idea of the city as a living lab to validate and prove the business cases of innovative transport solutions. Here, the objective is to create an ecosystem that will enable multiple stakeholders to experiment with, and prove, new technology concepts for the development of an integrated transport system ('MobOx Living Lab' 2017). In collaboration with other organisations, this transport system is, unsurprisingly, one that focuses on project areas such as connected autonomous vehicles, hydrogen and electric vehicles, and smart parking (Morgan 2018). The way that Smart Oxford supports these innovations and the process of embedding them into current and future practice can be seen as an attempt to encourage citizens to come up with new and innovative ways to un-learn and then re-learn how to navigate and know the city, with these smarter ways of navigating and knowing increasing access and connectivity to the city—digitally, economically, socially. What this further demonstrates is that Smart Oxford approaches ideas of smartness through technologically enabled and networked access and connectivity, motivating engagement and buy-in from members and citizens by appealing to individual self-interest and commoditisation as a way to stimulate 'smarter' solutions through the efficiency and motivation of competition.

Smart Oxford's brand of smartness in practice

According to a 'local industry strategy' paper published by the Oxford Local Enterprise Partnership (OxLEP), one of the organisations on the Smart Oxford board, the "brand 'SMART Oxford' recognises Oxford as a centre for developing products and services that use big data, Internet of Things, and Robotics" (OxLEP, n.d., 32). Within this document, across Smart Oxford literature, and discursively, the ideas and processes upheld as worthwhile and necessary for the establishment of Oxford as a smart city were those that facilitated and contributed to the idea and realisation of Oxford as a living laboratory with citizen led smart solutions, experimental corporate products and services, and generally disruptive technological solutions to social and environmental issues. Yet for all the labelling of 'smart' projects across Oxford, very few, if any at all, are those conceived, managed, or maintained by Smart Oxford.

In general, Smart Oxford's approach was less interested in creating or owning projects, and more about facilitating partnerships through which to join already existing projects. To that end, their original strategy was to inquire after relevant organisations, ascertaining the type of

work they were doing, and how they are doing it, and help those partners achieve their goals, rather than managing and driving the projects themselves. Yet, as a result, while building networks, and the digital and information infrastructure underlying Smart Oxford, the initiative has subsequently struggled to render itself visible in the public eye, choosing to focus on existing projects and partnerships (co-branding scantily funded programs), rather than building their own profile and separate foundation.

An example of the type of project that was sought after and championed was the engagement with, and support of, the Oxford Flood Network (now the Flood Network). What this example will highlight is the discursive nature of the smartness that is produced and propagated by Smart Oxford. The way that Smart Oxford positioned and perceived this particular project displays a comparatively more ethereal and idealised type of smartness at play. The 'idea' for the project ticked all the boxes and carried the values that Smart Oxford wanted to be known for, regardless of how the project actually turned out or how it was ultimately perceived by its owner.

To put this example in context, it should be noted that flooding was held by Smart Oxford to be a severe threat to the city. In an urban resilience workshop jointly hosted by Smart Oxford and the City Council, flooding was of particular concern because "the combination of climate change increasing periods of extreme rainfall coupled with more development increasing run off from impermeable surfaces would make existing patterns of flooding even worse". This was the issue that catalysed the creation of the Flood Network, a system of wireless sensors monitoring the waterways and flood level around Oxfords. The network was jointly managed by a local developer and Nominet, one of the Smart Oxford stakeholders represented on the board. The flood network was a project that offered commercially available sensors which provide near-real-time updates on waterways, rivers, ditches, and groundwater. These sensors connected wirelessly to a gateway which fed the data back into the Flood Network system where a digital map visualised waterways and water levels. This information was designed to help people make quick and accurate decisions during flood events, share knowledge of danger points quickly, and allow them to react appropriately in fluid situations.

Speaking to the founder of the Flood Network, I was told that the original 'dream' for the sensor network was that it could be deployed by every day citizens as "some sort of guerrilla

network", where there would be sensors out there that people didn't even need to know about, gathering data, and "just doing things". The idea was to build a monitoring system using the latest IoT developments for the benefit of those living in the flood plains. For Smart Oxford, this project ticked all the boxes, it was led by an innovative individual with an idea that they wanted to share, it was an obvious benefit to society, it used the latest technologies, and it was a scalable project with a marketable product. However, as the technology developed, not only was it even harder for people to attempt to assemble the sensors themselves, the sensors also became more expensive and less socially accessible, with the cheapest sensor now being £250, with sales figures now, unsurprisingly, low. As time went on, as the flood network fell behind the latest technological trends, and as it became less economically viable, the founder of the project said they felt that support and enthusiasm from the board waned as the 'novelty' of the project faded. To compensate for the dwindling support in Oxford, the founder told me that the Flood Network expanded beyond the city and is now being piloted by the City of Bradford Metropolitan District Council, the City of Cardiff Council, and in Indonesia. From the founder's point of view, the dream of a citizen-led network gathering data and 'just doing things' is long gone and is a "disappointing failure" because it had not taken hold locally. Yet, from the perspective of Smart Oxford's focus on citizen-science to develop sellable and socially beneficial applications and networked systems, the Flood Network is seen as a success and used in its promotional literature.

Thus, even though the founder felt that his dream of a citizen led network of flood sensors was a failure due to the rising cost of development and production which led to a decrease in local engagement, for Smart Oxford, the fact that the project was conceived of and spearheaded by a local resident, the fact that sensors tapped into IoT technology and produced an innovative product at the forefront of technological application at the time, and the fact that the project has expanded nationally and internationally meant that the Flood Network was regularly held up as an example of citizen ingenuity and achievement. This illustrates a tendency to view success and smartness in terms of the outcome rather than the process, what mattered in this case was that ultimately, the sensor network produced a commoditisable 'smart' product that benefited society and addressed flooding and that it expanded and was being trialled in other municipalities and countries. Additionally, this demonstrates the type of institutionally informed idea of success which shapes Smart Oxford's ideas and public discourse of smartness and achievement.

Conclusion

In this chapter, I looked at the make-up, history, and official smart city imaginary of Oxford, namely, the workings and story of the Smart Oxford initiative. The Smart Oxford's ideas of smartness were also analysed and discussed. Additionally, the group's motivations behind the drive for smartness were explored, most of which can be tied back to the more techno-centric, neoliberal smartness discussed in this literature review. Thus, in general, for Smart Oxford, smartness was about funding, technology and progress, and branding—selling smartness. One of the more interesting stories about Smart Oxford was that they feel the need to work so hard to frame and label this notion of 'smartness' in Oxford. But for them, it is more of a discursive instrument, it's not project, it's not resources, it's not leadership, and it's not convening, but it is creating a set of labels and flags that get planted.

Chapter 4 - Cyclox

This chapter examines and analyses Oxford as a smart city as imagined and practiced by Cyclox. Even if they did not discursively name it as such, it's about how Cyclox envisions the future of the city and the role of data and technology within that future. Cyclox's smart city is one where social wellbeing, sustainability, and urban infrastructure are inextricably linked to ideas of equality, social justice, and the delicate balance between society and the natural world. This reveals and reflects a sociotechnical imaginary of smartness that views data and technological innovation with a degree of suspicion and hesitation. This is not to say that Cyclox's smart imaginary is technophobic or that they are unwilling to engage with technological innovation, however, their relationship to data and the digitally mediated city is one of caution and measured apprehension. Cyclox's smart city is fragile, where there is a delicate balance between society, the environment, and technology that needs to be carefully maintained, where the slightest nudge can send the system into a spiral. This perception contributes to a city that is combative in nature, where Cyclox felt that it was constantly fighting a battle to redress power imbalances and ideas of technological intervention and 'progress' that they felt were a danger to the system as a whole.

In this first subsection, I will first introduce Cyclox as an organisation and examine its organisational structure and style, followed by the social dynamics within the group and central committee that steers it, I will then explore its vision and values, and I will conclude the section with a discussion on how the group perceives and imagines the nature of the environment and their relationship to it and the future. Following the detailing of the inner workings of Cyclox, I will explore the theme of contested space and ownership which repeatedly appeared during my time in the field. Finally, I will conclude the chapter by discussing Cyclox's perception of technology and their idea of what a 'smarter' future should look like.

The eco-centric sociotechnical imaginary: Introducing Cyclox

It is a relatively cold and overcast Saturday in mid-June 2018, the wind is picking up, and rain is lightly falling, promising to get heavier as the afternoon wears on. It is not the type of day that naturally inspires visions of outdoor family-friendly community festivals, complete with live music, fancy dress, face painting, and show and tell. Yet that does not stop those stalwart few who forgo the comfort of a book and a blanket and make the effort to come out and mingle at the Rose Hill Cycle Festival. The festival is touted as a celebration of "everyday cycling for everyone".

Around 2 pm, when families begin to arrive at the Rose Hill Community Centre, they are greeted with the up-beat acoustic stylings of Local Oxonian musician, Trev Williams, as well as bike quizzes for the children (the prizes for which are to be given out at the end of the day), and agendas for the day's talks which cover topics such as using apps for safe cycle routes, women and cycling, electric bikes, and cycle training. Once inside the community centre, and past the face painting booth, there are stalls in the community centre's ballroom, with different groups and organisations manning their stands and enticing passers-by to join them in conversation with regard to their represented cause. The list of stall owners includes the Oxford Pedestrian Association were there, Cyclox, the Rose Hill and Iffley Low Carbon group, Sustrans (a national walking and cycling charity), among others.

There is hot and cold food on offer in the ballroom, both sweet and savoury, sourced from local food banks, with all proceeds going to the Rose Hill youth group. Out the back, there is a cycling obstacle course set up for older children, as well as another live band serenading those on the patio with interpretive pop, where family show and tell is scheduled to take place later on in the afternoon. To round out the day's activities, there are electric bike trials for those willing to give it a go and see what it's all about. Although, I can't help but feel a twinge of sympathy for the festivals' organisers as, for all the preparation, handing out all the pre-event flyers, and the social media publication campaigns, the number of attendees and general community engagement seemed disappointingly disproportionate to the effort invested.

The above vignette describes the setting for my first face-to-face encounter with Cyclox as a group at the Rose Hill Cycling Festival. From this first encounter, I established close relationships with 4 main informants, seeing and speaking to them on a weekly or bi-weekly basis. Cyclox is the self-proclaimed voice of cycling in Oxford, a pressure group committed to transforming Oxford into *the* cycling city, imagining and enacting the future of the city through

predominantly egalitarian world views and forms of social order and organisation. The group is a volunteer organisation and composed of a central committee and two sub-committees, one focusing on infrastructure, the other on cycling culture and awareness, with a wider membership base of 467 (as of the 11th of September, 2019). Members pay an annual subscription fee of £10 - £15 (with different prices for waged, unwaged, or household memberships), with the relatively new option of now becoming a lifetime member. In addition to the membership fees, Cyclox also receives occasional sponsorships, for example, from Freeths Solicitors who sponsored them for a year. Also, there are also a number of cycle shops that give standing yearly donations. At the local Canal Festival in Jericho in 2018, where Cyclox was running a stall, I was told that although Cyclox merchandise is available at fairs and events, its sale is not driven by the need for profit but is used "as a way of raising our [Cyclox's] profile and engaging with the public". Indeed, the cycle maps that are sold for £1 are often a focal point at these festivals, with passers-by poring over the map for over half an hour, sharing their favourite cycling routes, shortcuts, routes to avoid, or even pointing out mistakes or inaccuracies. Yet, while the map is an open-source map, available to edit and update online, festival goers said they rarely go online to update these inaccuracies or input changes that may have occurred since the map's last printed iteration.

Cyclox began life in the late 1990s as a cycling campaign branch of Oxford's 'Friends of the Earth' (FOE) local group, although from the many interviews and conversations I had with Cyclox members over the course of a year, it was clear that members today do not know much about the group's early period or founding, nor did they seem anxious to plug this gap in their knowledge. This relatively nonchalant attitude toward the general history and 'origin story' of the group is further entrenched by the fact that Cyclox's website gives no information about its origins or organisational history. My informants' more detailed memories and awareness of Cyclox as a group came when a man called David Star revitalised and spun Cyclox out from FOE. More often than not, those I spoke to did not remember how, or precisely when, they came across Cyclox as a group, but David always featured as a point of reference for Cyclox's 'beginning'. Until his arrival, most of those I spoke to described Cyclox as a dormant non-entity, indeed, David himself said it had "petered out" by the early 2000s. One of my key informants who became involved in the early days of Cyclox's rebirth said that "David was incensed by the state of cycling, so he was looking around for like-minded groups and people, and he found Cyclox".

The definitive, but brief, description of Cyclox's inception came from David himself who stated that in FOE, the 'Cyclox campaign' was originally run by Lloyd Stone, who created the cycle map of Oxford that Cyclox still uses today. While Lloyd is no longer involved with Cyclox, due to a divergence of views, he has updated the map on a semi-regular basis and sends it through to the Cyclox central committee for printing and dissemination. Pre-2000s, David described himself as Lloyd's 'sidekick'. Upon returning from a 2-year stint abroad from 2001 - 2003, David found that Cyclox had all but disappeared and was "aghast . . . to see that cycling conditions had worsened". Using FOE's monthly meeting as a springboard, he proposed a new and independent cycle campaign for Oxford and thus, Cyclox, as it is today, was born in the summer of 2003 with David as chair and Lloyd as vice-chair.

Upon becoming the Chair in 2003, he "steered the group in a way where they were seen as 'angry activists', looking from the outside in, and angry about what was happening and the processes through which they happen, but with no means to work within them". Repeatedly, through informal meetings, interviews, and emails, I was told by Cyclox members that, initially, the group was generally perceived as confrontational, and engaged in 'angry activism'. David was chair for ten years, and the chair of Cyclox at the time of my initial engagement was his direct replacement. With this change in leadership, and as the group gradually evolved, with committee members leaving and new members taking their place, there was a move away from the more aggressive tactics to those of cooperation. The objective of this strategic shift was to facilitate a working relationship with local authorities to address perceived infrastructural and cultural urban policy shortcomings with reference to cycling in and around Oxford, to move "from confrontation to cooperation to achieve the group's aims and objectives".

When speaking of this tactical shift, Cyclox members often made an explicit distinction between activism and advocacy. The former tended to be used to describe Cyclox's early years, and the latter, the current group's aim and mode of mobilising change, with "[Cyclox] becoming an organisation that was more advocacy minded, a group that attempts to consult and work with the council, rather than against it". I was told that while anger has an important role in this type of campaign work, in that it galvanises citizens, people "need to go beyond being angry, because being angry won't get you anywhere . . . so, take the things that make you angry and work with the government to change it". However, during this shift, there were

two things remained virtually unchanged, Cyclox's organisational constitution (with only superficial edits made by David's successor[1]) and its manifesto and vision for the future, Cycletopia. These core texts, discussed in the following sections, provide insight into the approach and manner in which Cyclox experiences Oxford as *the* cycling city, and how it reimagines the future of transport, mobility, the environment, access, and connection with and through the city.

A horizontal structure and style of organisation

Prior to meeting various committee members at the Rose Hill Cycling Festival, mentioned in the opening vignette, my initial research into Cyclox began by reading their "constitution and rules", which I later discussed and used during interviews with central committee members to elicit further information about the story of Cyclox. The document is a succinct three-page charter that includes the group's mission and objectives, membership structure, organisational administration, financial structure and conditions, and annual general meeting (AGM) rules, among other things. Membership is open to "any person who lives or works in the City of Oxford or in the County of Oxfordshire, or otherwise has a reason to be a member, such as regularly cycling in the City" (Cyclox 2014b, 1). It is further stated that "where the Committee considers that a member's actions have brought CYCLOX into disrepute, they may propose that that person be excluded from membership. Any such proposal must be considered at a General Meeting of CYCLOX, and must be passed by a two-thirds majority" (ibid).

As for the general administration the constitution states that:

> CYCLOX shall be administered through a Committee, which shall comprise not fewer than five nor more than fifteen members who will be the executive body of CYCLOX, to be elected, by ballot, at the Annual General Meeting. All positions shall run from the end of the meeting at

---

[1] The constitution was further updated in 2020 when the group became a charitable incorporated organisation, however, this was just after I had exited the field and my discussion pertaining to this document is pre CIO-Cyclox

which they are appointed to the end of the Annual General Meeting following (Cyclox 2014b, 1).

It also notes that:

> Specific nominations to the Committee will be made for:
> a. Chair/Spokesperson
> b. Vice chair
> c. Honorary secretary
> d. Treasurer
> e. Membership secretary (ibid)

Although, regarding these specific and official roles, I was told that those who held these positions on the committee frequently just "fell into them, often reluctantly" because no one else wanted the role, so, the person "stepping up" was one of the more passionately active and dedicated members who had been performing similar activities regardless of the title. On several occasions, committee members classified Cyclox's organisational form as a "do-ocracy, where members do as much as they are willing and able to do", where the emphasis is on the relationship between group members and "chipping-in to the best of one's ability", where everyone is expected to do their part.

More formally, though, the constitution "was written to read like that of a charity" even though Cyclox's official status, at the time when my fieldwork ended, was one of an unincorporated association, a volunteer organisation. In conversation with the vice-chair, a former public health general practitioner, I was told that, in this respect, Cyclox is unlike other organisations of its kind who are usually community interest companies, charities, or community action groups. This "lack of formal status" was an issue that was close to the vice-chair's heart as they wondered aloud "whether [Cyclox] is really accountable to its members". From January 2019, when the previous vice-chair was elected chair, the potential incorporation of the group was put on the committee agenda, with the first introduction of the item laid out below:

We are currently classified as an unincorporated association, all liability falling on us as members of the committee . . . [several committee members] will bring a paper to the next meeting that explores options for becoming incorporated or whether we should remain as we are. The options for incorporation are a charitable incorporated organisation, a social enterprise such as a cooperative or community benefit organisation, or a company limited by guarantee (committee meeting agenda, 8th of January, 2019).

Following a detailed discussion of the pros and cons of each organisational form, the committee held a vote and decided that Cyclox should take the proposition that the group become an incorporated entity to the 2019 AGM. Overall, the argument for incorporation was based on the desire to "legitimise their [Cyclox's] status in the community", gain public respect, as well as clarifying and distributing liability as currently, "committee members are individually liable". The discussion against changing Cyclox's organisational status sprang from the fact that being unincorporated had "worked for almost two decades", that incorporated entities must publish details of directors and members (which seemed to be unpalatable), and that this shift would require, on an ongoing basis, heavier formal administration processes and procedures. That said, after a lengthy debate, there was only one committee member who staunchly opposed this shift, citing previous experiences where incorporation placed limitations on the ability to campaign and complicated and formalised organisational procedures to the point of rendering the group ineffectual. Thus, the wheels were set in motion, and in 2020, Cyclox became a Charitable Incorporated Organisation.

Community-based social dynamics and leadership

Initially, when my engagement with Cyclox began, it was put to the committee that I be granted a standing invitation to monthly central committee meetings and bi-monthly sub-committee meetings as well as my general participation and engagement with the group in a less formal manner. After this motion was formally passed by the committee on the 17th of July 2018, I became a regular attendee and an unofficial, non-voting, committee member. As part of this process, there was also the question of whether or not, as an 'outsider', I should be granted access to the shared committee Google drive and put on the internal committee mailing

list, a constant and busy stream of communication and organisation. While my key informants did not have any qualms about this, the chair, who was a former Oxford University lecturer in Immunology, was far more reluctant. As my informants and I discussed this hesitancy, the explanations they offered were that the chair might be worried about my portrayal of Cyclox to the outside world, or that it was a general concern over the opening up the inner workings and discussions of Cyclox to a non-member. Only when the vice-chair proposed that I sign a non-disclosure agreement did the chair become more comfortable with the idea and give consent. While we planned to find a generic agreement online for me to sign, it never came to pass. The vice-chair mentioned it several times in passing as something that we had forgotten to do, but it was then promptly forgotten again.

Throughout my fieldwork and until the vice-chair stepped into the role of chair in 2019, when discussing the leadership of the group as a whole, every informant pointed out the chair's incredible attention to detail, the aspiration of building of trust between Cyclox and the local councils, an in-depth knowledge of Council processes and procedures, and an extraordinary understanding and familiarity with both key and relatively obscure local policies and guidelines. Initially, I was informed that the early committee agendas were planned in such detail that each item included the precise time the discussion would begin and end. In a two-hour interview, I spoke with an activist journalist who was recruited by the chair not long after they took the position in 2013. The first thing the journalist spoke of was their immediate respect for the chair after they attended their first committee meeting approximately five years ago, in 2014, and saw these rigidly adhered to time stamps and ordered agendas. The journalist felt that the chair "respected everyone and knew their time was valuable and provided a structure that made the best use of the time that they had". While these time stamps were gradually phased out, the respect that it evoked in that particular informant remained strong.

However, in other cases, the detail and rigid structure of these meetings were felt by other committee members to be too dense and somewhat esoteric, to the point where I was told that "no one bothers to read the agendas anymore". More than once, informants said that committee meetings were a "one-person show", with the chair dominating the room. One committee member informed me that they didn't "like going to committee meetings" because they "couldn't really contribute". Over the course of my time with Cyclox, although the chair was much respected, I was told that many people felt "disempowered" and "talked at", where

it was felt by some members that the chair "doesn't consult, s/he speaks". Officially, when the chair announced that they would be stepping down at the end of 2018, it was because they had always said they would only serve for five years, and those five years were now up. Yet, when I brought it up at the 2018 Elder Stubbs festival, a summer community festival at the Elder Stubbs Allotments in Cowley, the chair said that Cyclox needs a "shake up, someone who will lead them in a new direction, with a new style". When the new chair was announced, the previous chair told me they were surprised as they thought it would be someone who was more radically minded, who would stage die-ins, a form of protest where participants pretend to be dead, and similar activities. I was left with the impression that they expected the leadership style to revert to the more activist minded direction that had been in place before they became chair, the direction they had consciously worked to change.

This stark juxtaposition of leadership style and manner of conduct, between 'early' and 'current' Cyclox, was a thread that ran through discussions of Cyclox's history, past and present strategy, the impact it had upon the group's external reception by the general public, as well as the impact upon internal relationships and morale. Of the "early movers" in Cyclox in 2003, only two are still actively engaged, the chair who stepped down in 2018 and a committee member who works in city repair and maintenance. The original chair and vice-chair are now, quite conspicuously, uninvolved. Looking into this further, I spoke to a committee member who had been involved with Cyclox for over fifteen years, which not only pre-dates David's time as chair, but it also covers the transition following his term. In an interview that took place in a crowded and noisy café, I began by asking my interviewee the standard questions regarding Cyclox's history, personal involvement, and organisational dynamic, they lowered their voice and said that after fifteen years they "won't be on the committee for much longer" as they had "had enough time . . . we need new people, and I'm worn down and cynical". This cynicism, they said, was borne of the fact that "it's very very easy for people in local government to play a straight bat and be nice to groups like Cyclox, but just let them wear themselves out".

When asked about the organisational dynamic, this particular informant was more direct than others, who seemed to skirt issues of internal conflict.

> As far as I can tell, there's always been the tension between people who
> want to focus on responding to planning applications in a sort of calm way,

and people who want to be urban warriors and go and get a sledgehammer and knock down bollards and things . . . There were frequent fallings out between people along those lines, and expulsions in the end . . . there was one person who got expelled from the committee for basically trying to set up his own sub-section of Cyclox to get on with knocking things down.

The departure of these early figures was often underplayed and excused by life events, and while the significant moments of starting a family or moving outside the city centre are most certainly key factors, the underlying tensions of divergent views, methods, and a sense of 'falling out' was almost always present. Throughout my time in the field, general disagreements in the group over campaign priorities or strategies were handled through open debate at committee meetings, however, these disagreements were not of a nature that threatened core Cyclox values or commitment to the group.

The Cycling City: Visions, values, and cycling for a better world

Throughout my time with Cyclox, the vision and mission of the community was unwavering. Cycletopia, their vision for the future of Oxford as a cycling city, galvanised and animated the community and underlay the group's mission, strategy, and everyday practice. As stated in their vision document:

We want a future where . . . the wellbeing of the city is supported by clean air and active travel. We want to see cycling at the heart of that future, enabling everyone to get in, out and about the city freely and safely (Cyclox 2014a, 1).

When discussing Cyclox's vision in interviews, and why Oxford as *the* cycling city was so important, an informant emphatically told me that "cycling is the answer to everything", another said that it is "a panacea for so many things, air quality, mental health, social inclusion, and climate change . . . the thing about cycling is that it ticks every sort of sustainable lifestyles box". They continued, stating that "essentially we want a city which is healthy, people are happy, we have a great economy, and where people can get in, out, and about the city safely by bicycle . . . who wouldn't aspire to that kind of city? And if you ask yourself the question

'to what extent does cycling support that vision?' the answer is that every single box gets ticked." This mind set and the overall imaginary of Cycletopia emphasises the "current and future potential of a cycling city", where people "cycle for economic growth, and cycle for health, inclusion and access, clean air, and carbon reduction". Parenthetically, Cycletopia will also be further discussed in the closing chapter of this work, in comparison to Smart Oxford's vision of the future.

Not only is cycling seen as the solution to environmental crises, but also something that facilitates and maintains social bonds. In a screening of the Dutch film entitled 'why we cycle', organised by Cyclox and held at Oxford Brookes University, those on camera stated that they believe it increases the potential exposure to diversity, where one meets and has to make eye-contact with the proverbial other, where you negotiate the traffic flow, make split second decisions based on reading people's faces, and where face to face connections in a public space is unavoidable, all of which allow that space to socially and physically function. After the documentary finished, I spoke with those in attendance who echoed the sentiment that cycling promotes social contact that is open and personal, and as a result, the rules of the cycling community are more open and tolerant. Further, cycling was envisioned as the solution for a community in need of social connection, and it was also seen to uphold and maintain the sanctity of the environment and the future of the city, which will be further discussed in the section below.

Ecocentrism: The nature and value of the environment

Cyclox's perception of the world was predominantly ecocentric, with nature and humans being inexorably intertwined in a fragile and delicate balance, with a particular focus on the social and physical marginalisation of particular city dwellers, namely, cyclists and pedestrians. The wellbeing of the environment and the wellbeing of those in the city were considered one and the same. When it comes to the future of the city in response to urban challenges such as climate change, Cyclox believe that environmental degradation and crises can, unsurprisingly, be most efficiently and effectively tackled by an uptake in, and commitment to, cycling. When asked, my informants would list climate change, mobility, and social and physical inequality as the most pressing urban issues facing Oxford as a city (not necessarily in that order). Underlying most committee meeting discussions, in many informal

conversations and through many consultations responses, Cyclox members argued that cycling addresses these issues directly and can be taken up quickly and cost effectively without needing to invest large sums of money into smarter energy grids or driverless network systems. Equally, the risk of social disconnection and crisis of public health were imbued with a sense of urgency and looming danger, where cycling was seen as the 'the logical answer' to this imminent threat, and a failure to recognise this by investing in expensive and large sensing projects and technologies instead would result in the deepening of these crises.

What was clear was that the underlying perception of the environment was one where it was perceived to be in a state of extreme fragility and facing a looming threat brought on by cars and consumption, where the delicate balance between human impact, social justice, and sustainability was fast approaching a tipping point from which there would be no return. There was no question that the world was facing environmental disaster, that there was limited time to effect change, that people were disproportionately impacted, and that humans were the cause of said disaster. "There is no safe level of nitrogen oxide . . . not only that, traffic exposure tends to be in areas where poorer people live. There is a social equity implication and the polluters are often not the ones being polluted. People driving into cities are polluting those who live in cities". For Cyclox, it was clear that addressing climate change, creating a brighter future, and making any sort of impact would require mass common effort and commitment to change. In an interview, one committee member said that developers and developments focus too much on managing rather than addressing climate change and urban planning issues, I was told, in this same conversation, that unless a plan could be proven to "positively impact the environment rather than just mitigate risks of going ahead with developments", it should not go ahead.

In this way, the people and arguments that found traction within Cyclox were those that recognised and addressed the imminent threat to the city's environmental and urban spaces, power inequalities, and those that recognised the reciprocal relationship between the health of the people and the health of the environment. A Cyclox member, who described themselves as "motivated by environmental and social sustainability", wrote the following in a position paper on air quality:

Campaigning for improved air quality is symbiotic and synergistic with the aims of Cyclox, and in fact, a potential vehicle to accelerate investment in cycling . . . The fact that poor air quality damages our health, and in particular the development of children, means that it cannot be left to another generation to sort it out. Urgent action is required and with increasing awareness of the consequences there is a growing demand for action which Cyclox should support and leverage.

Speaking to a retired patent lawyer and discussing urban planning and spatial equality, the same type of argument was put forward, "people have just gotten into the mind-set that if there's a cyclist and a car on the road, the cyclist is in the way but it's just not reasonable to think that car drivers have a greater right than the cyclist . . . and that's part of the way that cars have dominated society, which needs to be broken down so that people can be safe in the city, both in terms of cycling safety and pollution". Speaking to a committee member at the 'Roads are for people' event jointly organised by Cyclox in 2018, they told me that "you want a city for people, for *everyone* in the city, not for cars" (original emphasis).

When asked about the cycling lifestyle, why it was important, and what it was that people in Cyclox were so passionate about, an informant told me that "we don't want to be in these cities choked up with all these fumes by people who have personal motor vehicles and just create and sit in traffic. And we see what's happening with climate change, the health service and people polluting and then getting sick. . . and so to me, walking and cycling are just completely obvious things to do . . . You're not polluting your environment, you're not making people sick, you're not pushing us over the tipping point. And so I just can't understand why everybody doesn't do it." What became clear over the course of my fieldwork was that the core assumptions and patterns of behaviour of Cyclox emphasise equality and rely on the 'ethics and morals' of the community to "do the right thing, after all, who wouldn't want to live in a healthier, happier, and less polluted city?". As one informant said:

I think it is morally unacceptable for people outside this city to drive past my house and contaminate the air and local people's child development because they pay road tax or they pay fuel tax and they have a right to do that. No, you don't. And even if you gave me some money for that, it's no

compensation, you do not have a right to harm other people by taking an action which is selfish

Across these arguments, there was also a call for more "holistic thinking . . . for people to not think in silos". Underlying every discussion, interview, official Cyclox position paper, and option was a shared assumption that everything is connected, physical infrastructure and access to safe cycling routes impacts social cohesion and mental health, reduction of cars increases exposure to 'the other' and builds a sense of community, and at the centre of these connections was the environment and the relationship between people and nature, "I've definitely realised that Cycling is the panacea for so many things, it is '*the winning*' solution, other than eat less meat, for saving the planet".

Thus, it is fair to say that throughout my time with Cyclox, issues of urban planning and mobility in Oxford were seen through the lens of social and physical marginalisation but also in terms of the impact on nature and the environment, where external institutions and organisations develop and implement policies which socially and infrastructurally reinforce the unequal power distribution between cyclists and motorists. This was symbolised in their staunch arguments for the reprioritisation of public space to favour cyclists, their commitment to equal access to infrastructure within and across the city for cyclists, and redressing the environmental degradation brought about by Council policies and city engineers who "design out" travel choices and "make it increasingly difficult to choose cycling as a mode of transport". I was often told by informants that, "when it comes to local policies and really making a difference, you think you're getting heard, but you're powerless". Here, the underlying perception was that although Cyclox's cause was just, existing structures exacerbate and reproduce inequality and hamper any effort to make meaningful change in terms of power structure on the road and in the city.

Social and spatial inequality, and the contested nature of urban space and ownership

Throughout my time with them, notions of owning the future of Oxford and reclaiming the city for cyclists, as reflected in Cyclox's unwavering commitment to Cycletopia and by

their consistent engagement with public urban planning consultations, suggested an atmosphere of disputation and combat. Further, it suggested that the everyday practice of cyclists and the existence of Cyclox is one of contestation and competition for the city.

This vision and their everyday practices advocate for, formally and informally, cyclists and pedestrians to be prioritised socially and materially in an attempt to "address the power imbalance on the road and give everyone equal access to the city". In discussing Cycletopia and Cyclox's raison d'être in the homes, local pubs, and cafes of my key informants, as well as in interviews with general committee and group members, I was told that this is based on the perception that motorists have been "put on top of the hierarchy" and that there is a "car culture of dominance where might makes right . . . where cyclists and pedestrians are physically and socially marginalised". Further, I was told that "city engineers don't consider cycling to be a form of transport". Generally, the people who were praised and the policy arguments that were lauded were those that focused on redressing the "power imbalance" between cars and cyclists by investing in infrastructure "that will give everyone equal access to and through the city rather than prioritising and protecting those who drive, which only increases pollution and wear and tear, and pushes everyone else off the road".

Sitting in a café on George Street with an informant, watching cyclists, people, and busses pass by the window, I was told that having 'proper' cycling access and continuous routes at forefront of the minds of city planners, designers, and engineers would not only be in the public interest in terms of intangible benefits for society, but would "change the very nature of cities". They further stated that:

> If cities were thought of in terms of cycling distance and time, then networks, systems, and central spaces would be more compact, with more open and public spaces, creating a shared space where roads aren't just about *going* places, they *are* the places.
>
> . . . The goal of a city is to maximise levels of social activity for everyone in the city . . . If you don't have connectivity and continuity, only certain people have access, and so access is restricted. If there is no access, there is no activity, and without activity, there is no city . . . Improving access to

town centres by bike and foot is one way of reconnecting them to their surrounding areas and ensuring their [the city's] survival.

In speaking of the overall 'state of things' and of those who currently make policy decisions, national and local governments, I was told that these relationships and connections are not taken into "proper account":

> The single minded pursuit of economy above all other things has perverse consequences. Now, if you pursue the economy and don't care about pollution, and the environment and social welfare, and you know, everybody else, that's what actually causes the consequences that we all then need to pay for. So how much better to start with a holistic view with which decisions are made. I wonder whether local and government decision making has the right structure to make decisions in the right way because if you've got siloed departments, they will pursue their own silo.

As illustrated by the above, it was clear that cars were felt to be unjustly prioritised and protected to the detriment of the city—socially, infrastructurally, and environmentally. Throughout my time in the field, the issue of spatial and social equality and the resulting safety concerns borne of those inequalities were key motivators for the group's activities and were also the key drivers of Cyclox's two main campaign priorities, the creation of "attractive and healthy streets for all, and safe connected cycle networks". Here, Cyclox, formally and informally emphasised that not only should cyclists be given full access to the city infrastructure, in terms of space and adequate cycle lanes and routes, but that they should be prioritised in their right to navigate and engage with the city. In the minds of all I spoke to, there was no question that this prioritisation and reallocation of space would "improve air quality, reduce carbon emissions, and most importantly, improve the heath for all those who live in and visit Oxford. Everyone benefits".

One particular characteristic and source of collective solidarity was a shared opposition to the 'outside' world, where 'blame' was, in large part, laid at the feet of the 'system'. This meant that Smart Oxford and Council policies and strategies to address climate and urban planning issues through investment in what were seen as unacceptably expensive and time

consuming developments, and underinvesting in the "obvious answer of cycling" in relation to reduction of carbon emissions were often criticised for introducing unnatural inequality, whether it be the social and physical dominance of cars over people, urban design favouring motorised transport, or the predilection for smart transport over "people powered" sustainable mobility. I was told that "there is a culture of motorist dominance. It's political rather than geographical". In discussing urban planning and those who are prioritised and marginalised as the result of urban design, an informant stated in an email that:

> Further to my concerns that the City Engineers will be a 'new' enemy in highways engineering . . . this little story lingers on . . . Note the unwillingness to be pro-cycling. Even stop-gap measures work against cycling. How much wider to battle on this? We want the 'big' changes but every tiny step is made into an impediment.

Further displaying this kind of thinking, in a public talk on local campaigning, organised by Cyclox, an employee of Cycling UK who works in the campaign department stated that trained engineers are taught to "design out travel choices", hampering the free and equal choice of modes of transport as people navigate and access the city. During my engagement with Cyclox, not only was 'the system' blamed for restricting travel choices, but also organisations who reinforce these structural and environmental inequalities and public and private investment in technological development with the sole aim of economic growth at the expense of environmental sustainability, the disempowered, and the marginalised. The arguments that gain traction within Cyclox and the opinions that seem to shape priorities and responses to Council policies are those that uphold morals of equality, social justice, and the common good.

In responding to the Oxford Councils' 'Introduction to Oxfordshire 2050 plan', a combined Oxford County Council document which sets out aspirations and ambitions for Oxfordshire in 2050, an informant told me that they were disgusted by the fact that in the outline of the aspirations to protect environmental quality, "apart from one closing sentence, the absolute imperative of addressing climate change issues urgently is not mentioned", flippantly adding that "it would not be unreasonable to suggest that climate change is significant enough to warrant a text paragraph and objective of its own". This 'blame' and

attack on the larger system for inadequately dealing environmental issues constantly alludes to a coming catastrophe should Cycletopia not be achieved. In another response to a city council policy, one that lays out tentative plans for the city centre, the 'Oxford Central Conversation Area Draft' 2018, a Cyclox member's noted in response that "currently, the city's streets appear to be treated with a late 1960s', car is king, mind-set. This is not good enough at any level". Responding specifically to a section on 'movement and activity', in Cyclox's official response, it states that they are "concerned that cycling as a mode, needing coherent and safe provision, is not mentioned. The exclusion is of great concern to us."

Another example of the combative and contested space that influences Cyclox's everyday practices and activities can be seen in Cyclox's focus on the need to address the immediate threat of climate change through investment in 'easy to implement' active travel solutions rather than expensive, long-term development projects.

> Our message is the need for rapid investment to make Oxford a healthier and safer city for pedestrians, cyclists and road users generally and emphasising the urgency to ensure that the City's environment is protected and enhanced, before major new developments . . . introduce yet more traffic into Oxford's streets (email communication with a Cyclox member, 2018).

Cyclox members stated that while their relationship with the councils has improved, the "cycling community still faces an up-hill battle, if not a losing one, when it comes to convincing urban planners and the local government that having a 'city that cycles everywhere' has superior economic and social potential", that "Cyclox is up against the Oxfordshire County Highway control". Yet all this is not to say that Cyclox and the Councils cannot or do not work together. Cyclox and the Councils have been working to establish a trusting and mutually beneficial relationship, however, while they may agree on the fact that something needs to be done about environmental degradation and urban planning, the actions agreed upon are often for different reasons. Further, despite working with the councils to improve policy, issues of inadequate climate change strategies and urban planning policies are still seen as the outcomes of ineffective and misguided 'system' structures. I was often told by informants that the councils are reluctant to spend money on cycling infrastructure and cycle friendly

developments, as they feel that there is a perception among developers and city planners that this type of investment is costly, yields little return, and puts the city at a disadvantage in that it is not making use of latest technologies and trends. During a committee meeting discussing just that, one committee member stated the following:

> The problem is that everyone assumes that we [Oxford] can't afford to invest more in cycling, but that's just a lack of systemic and holistic thinking because cycling actually saves money. For example, its positive impact on the cost of healthcare, if people are more active on bikes and reaping the mental and physical health benefits of cycling, the NHS wouldn't be so overburdened.

In further seeking to understand ideas of contested space and ownership, notions of *access* and *connectivity* became important themes around which claims on and for the future were lain. For Cyclox, ideas and visions of access and connectivity are predominantly thought of in terms of transport and mobility in and around Oxford, where social and infrastructural access and connection are strategic cornerstones of a smarter future.

From Cyclox's point of view, the foundations for enacting smarter futures and enabling smarter choices were to be found in social and physical access to the city by way of "cycle and pedestrian friendly public spaces", and the "social freedom to meet and mingle on safe streets where children can play without undue risk from pollution or motorised vehicles". But this access is not just about resisting through-traffic or the inevitable particulate pollution of autonomous and electric vehicles. It is about ensuring and accessing the social cohesion of the space, it is about the ability to stop and talk, to socially connect rather than digitally disconnect from the world around you.

Over the course of my engagement, however, access, in some ways, also came to represent restriction, notions of filtered exclusion, and filtered permeability. The type of access that Cyclox advocates for, through all formal and informal consultations, speaks to cyclists and pedestrians being granted priority access, not only in areas where they feel marginalised and threatened, but ideally, throughout the city. This priority access, then, downgrades the priority of motorised vehicle access and the investment in sensed road networks, restricting vehicle

access or prohibiting it altogether. Examples of strategies of filtered permeability that were often proposed by Cyclox to support the creation and materialisation of Cycletopia were the instalment of bollards, sealing off neighbourhoods with no-through traffic conditions, campaigning for car-free zones, and introducing time restrictions to cars in accessing spaces and neighbourhoods. This restricted access is justified by appeals to public health and safety (with a particular focus on child safety), sustainability, addressing mobility power imbalances, and creating public spaces for locals to gather and socially connect and build a sense of community.

While these measures do not exclude people, *per se*, they are an attempt to exclude (partially or wholly) those people who choose to, or have to, travel in motorised vehicles, which further illustrates the frequently displayed 'us' vs 'them' mentality. Speaking to an informant who was particularly fervent in their campaigning for filtered permeability and closed traffic neighbourhoods, I was told that what these restrictions are "meant to encourage, or force if necessary", is the creation of an environment where "people travel, interact, and engage in a very different manner than they do now". In addition to political campaigning, he also spoke of softer cycling enabling measures, as opposed to policy changes through official channels, such as a buddy-cycling-system, where an experienced cyclist accompanies those who are new to the area, new to cycling, or who are less confident cyclists, again, building a sense of community and togetherness. This confidence, it was then put to me, would contribute to behavioural change, "first changing everyday practices, which would then change embedded societal values", making for a better, safer, smarter future. Similarly, I was told by another informant that 'smart' solutions such as "smart meters and cycle counters might be more visible, but I'm not sure how much it will change behaviour".

In this way, Cyclox saw smart to be something that physically connected streets and networks for cyclists to have access to continuous routes that enable them to safely navigate the city. Equally, connectivity was also thought of in terms of the social good, where cycling is felt to bring people in the community closer together, where people wave, stop and talk, where eye contact facilitates a bond with others in the same space, where people empathise with other road users and anticipate other road users' actions to facilitate and negotiate urban mobility.

Smarter futures

At the end of my time in the field fieldwork, Cyclox were in the process of formalising their ideas of smartness in the form of an official statement and position on cycling and smart cities. This was prompted by the annual re-evaluation of strategy and campaign priorities, when the need for a position on smart cities was raised in conjunction with the formalisation of their vision for the city centre. When the idea of a formal position on smart cities was first proposed, it was in a weekly Skype meeting between myself and the vice-chair, where I was asked to prepare a statement and bring it to the committee meeting for discussion. This discussion arose from the committee's desire to formalise their vision for the city centre as a space for active travel and social interaction free from the disruption of motorised vehicles and related air and noise pollution. Conscious of maintaining the balance between my roles of participant and observer, I made it clear that it would be inappropriate for me to write or influence the committee's position or proposed engagement with the smart city concept.

When it was first tabled at a full committee meeting, the general impression and purpose of smartness and smart technology were seen as something that should support rather than drive physical and social connectedness. Continuing to demonstrate a strong commitment to egalitarian norms and values, it was felt that the physical and material ideas of being smart should speak to inclusive public spaces accessible to all, the facilitation of social bonding through open and safe place-making by way of low traffic neighbourhoods, "creating streets and places for people", and a connected, continuous, and safe cycle network. In this round table discussion, it was further remarked that the intangible qualities of smartness should focus on a type of social connectivity and access thought to be brought about only by a stronger cycling and active travel culture, where being smart means making decisions and implementing policies and programs that improve the wellbeing of the city in terms of levels of mental and physical health, reducing the environmental impact of the city, and increasing participation and civic engagement in the making and enaction of public space.

From my time with Cyclox in the field, it was clear that ideas of a 'smarter' future as represented and connected by networks of sensors for autonomous vehicles and electric vehicle charging stations was seen as one that would exacerbate and compound urban challenges such as climate change, urban planning, and mobility. This 'smart transport' vision was mobilised

by Cyclox as a direct example of what the future and application of technology ought *not* to be, and the type of future that ought *not* to be striven for. Instead, the 'smart' city as envisioned by Cyclox is one where technological innovation is envisioned as something to support physical and social connection and access to the city, where things such as the electric bike demonstrates the type of technology that shapes and belongs in, but does not underpin, Cycletopia.

Thus, what can be seen is that connecting and accessing the city through the distinct visions and practices that Cyclox engage in and advocate for are in opposition to the idea that the way to reduce congestion, pollution, and traffic is to invest in sensing systems for traffic mapping and management, autonomous vehicles, and electric vehicles and charging stations. These 'smart solutions', they argue, are not the 'answer' they promise to be. Even if shared driverless vehicle systems are put in place (as is envisioned by the City Council and Smart Oxford), Cyclox argue that autonomous and electric vehicles will not adequately address issues of congestion and traffic. For example, when discussing ICT and technology heavy definitions of smart cities, the committee felt that the "ideas and applications of smartness have their priorities inverted, as they seem to be providing technical and technological solutions to *avoid* cycling, even though it is the most *obvious* way to reduce congestion and pollution" (original emphasis). What this shows is that Cyclox's sociotechnical vision and ideas of smartness are not necessarily anti-data or technophobic, indeed, they recognise the importance of technological innovation, data, and the increasing amounts of available digital information (as previously discussed), however, these are to play supporting, not leading, roles in the infrastructurally and socially connected and accessible city as imagined by Cyclox.

As pointed out in meetings, interviews, and email communications with the committee, it was felt that, lamentably, autonomous vehicles and technologically enabled transport were seen by city planners and urban contractors, without question, as more economically and socially desirable and beneficial. By way of example, on March 19, 2019, the Central Government released a policy paper, *Future of mobility: urban strategy*, which sets out the government's approach to innovation in urban transport. A week later, the paper was making the rounds through the cycling community. In a community-wide newsletter, under the heading 'predicting the future', it was noted with dismay that local and national governments tend to succumb to:

The seductive appeal of technology as the solution to all our problems [which] applies particularly to transport and the government has produced a policy paper with an emphasis on self-driving vehicles and internet connectivity.

In committee meetings, when the hotly contested ideas of smart roads and autonomous and electric vehicle networks came up, what was often expressed was the local council's misguided investment in 'energy saving' electric vehicles and shared autonomous vehicle schemes, which the committee say will only have marginal benefits at best. In other words, the smart mobility and transport as envisioned by Smart Oxford and the Councils are not seen as 'smart' at all. Again, this is not to say that Cyclox are anti-technology, but it is to say that the type of sociotechnical imaginary that Cyclox are orientated towards views the idea of smart traffic meters and sensors as something that should be opposed. Here, again, Cyclox's notion of a smart city wouldn't necessarily be digitally or technologically-led, it would be one where digital technology works in service of the access and connectivity in the physical infrastructure that they are advocating for. In this way, Cyclox's understanding and mobilisation of technological development views technology as both a source of help and harm.

That said, as this section demonstrates, Cyclox's smartness is not something that exists in a world without technology, nor is that something that was desired, it is just the manner in which this technology and data is imagined and mobilised that is different and at times, incongruent, with the more popularised neoliberal notion of smartness and technology. For example, on the 17th of December, 2019, Cyclox published an article on their website about a 'smart bike light' trial as well as including a short blurb about the lights in their December newsletter as well. Smart Oxford, along with the County Council, partnered with a smart bike light company called 'See.Sense'. The trial is one to test the ACE light, which is a USB charged rear bike light on offer by See.Sense. The light connects to a smartphone app that allows the rider to share their insights for the benefit of other users and Planners, the light sense notifications when and if the bike is moved without the owner, a contact is automatically messaged if the bike is involved in a crash, low battery notifications and brightness settings are controllable via the phone, and cycling statistics are also collected. The stats are such that the rider is informed that they have, for example, "burned off the equivalent of 121 doughnuts and saved 64 kg of CO2 relative to completing my journey with a car", helping to motivate the

rider and give them a more tangible sense of achievement. In addition to these functions, one of the main draws of the light is its reactive feature, whereby it flashes brighter in high risk situations such as intersections and it switches to a solid red light when the cyclist brakes.

From the County's point of view, the ACE lights from See.Sense will help them gather cyclists' data and general insight from around the county. The data that is generated from connecting to the See.Sense app is collected, depersonalised, and then shared with transport planners. Thus far, over 100 million data points have been collected in Oxfordshire, showing not only where and when people cycle, but also their speeds, obstructions, and road surface conditions. These data points and insights contribute to the continued development of a comprehensive cycling dataset. Other sources include Vivacity Labs, and the street lights sensors deployed throughout Oxford to identify road traffic users and monitor traffic flows and behaviour, using over 70 street lights sensors to count cyclists and pedestrians passing through over 120 junctions around Oxfordshire. Together, these sources and technologies are providing the county with an ongoing source of cycling data that will be used to inform how the Council can reprioritise road space to provide improved cycling space. By using the See.Sense lights, cyclists are able to see their routes and to be generally visible, but their long term hope is to make the rides more visible to the transport planning teams in the long term.

The roles and challenges of science and technology for Cyclox

The type of sociotechnical imaginary and public discourse that coproduces Cyclox's notion of a smarter and more efficient future is one that is not necessarily data-led or data-intensive. And while, until recently, this vision of the future had not been expressed with explicit reference to smart city rhetoric, their ideas and strategies for enacting the future is animated by a distinct type of sociotechnical imaginary of smartness supported by a strong commitment to ideas and practices of community, cooperation within that community, mutualism, and an underlying moral drive for equality and access to and across the 'city for all'. Drawing this thread through the theme of data and its place in the city, this section explores digital data in context, looking at how it is imagined, what it means, what is imagined it can do, how it is talked about, and how it is mobilised or resisted.

Technology and even the 'idea' of technology was frequently viewed with suspicion and engaged with hesitantly. Often, technology was associated with large "profit making tech companies", seen as "a potential drain on scarce economic resources", and felt to be "unfairly prioritised", all of which were seen as opposing the ideals of equality and community, and contributing to futures that were not necessarily brighter.

> You see a lot of innovation in cities, people want innovation, but it's driven by companies like Siemens, and their ideas of the future has nobody cycling in their vision of technology, electric and driverless cars, and amazing train systems . . . but having polluting cars, autonomous ones included, is really, really bad for the development of children's brains.

> And so much money goes to technology and digital innovations, when the solution is just so obvious and easy. So, when I see technology companies coming to present at Oxford University, it's full of technology, but they forget the human aspect to all of this. And actually, the old technology of walking and the cycling can be better. You know, it requires fewer resources, it doesn't harm the environment, it doesn't create pollution, it creates places where people can engage and talk to each other. Where in cars, technologically enabled or not, we are disassociated from each other because we're in a box.

Often, this mistrust in technology and its applications was also tied to the view that digital data is somewhat misguided in its use and focus. In a public meeting with the newly appointed County Active and Healthy Travel Officer, a position that was heavily lobbied for by Cyclox, the officer discussed plans to use data from a Strava Heatmap to identify Oxford's cycle networks. This suggestion was met with strenuous consternation as the data was felt to inadequately represent 'everyday cyclists' routes and data, as Stava's data was only felt to cater to those who are "extremely fitness focused", "I find the fact that you're relying on Strava very concerning. Strava is hugely biased, it doesn't represent everyday cycling practice, and it should not be used at all. I hope you have a better way of mapping routes, and if not, I suggest you find one". These emphatic objections further illustrate the deeply embedded ideas of equality and fairness, for, if cycling routes were mapped predominantly using these types of

114

technologies, the data and any resulting action would be biased from the start and not provide adequate representation of the population of Oxford, contributing to the continued marginalisation of the majority of cyclists.

That said, over the course of my time with them, I did see Cyclox make a concerted effort to, with varying degrees of success, engage with ideas of digital technology and data in ways thought to be compatible with their principles and campaign priorities. In 2018, in aid of facilitating and influencing the smart use of public space as envisioned by Cyclox, the committee received an anonymous donation of £10,000. To boost Cyclox's visibility and presence, the committee felt that the money would be best spent on something tangible, something that could be materially incorporated into the city. Three viable and achievable options were discussed:

1. Commissioning a local artist to create a mural
2. Paying for the visual mapping of cycle paths
3. Investing in a digital cycle display counter to present various data based messages and statistics

Demonstrating this attempt to engage with digital data, the cycle counter won the majority vote in the hopes that it could be used to process and real-time data and support a vision of the future that is not dominated by, or built for, electric vehicles. This resulted in the proposed involvement with a project being run by the County Council's Public Health Team who had teamed up with the Innovation and Research team to deliver a Smart (sensor) Detection System. This system currently consists of 70 sensors currently installed on various lamp posts throughout the city, tracking in real-time, traffic flow and modes of transport. The system is designed to contribute to the building of city-wide intelligence, mobilising machine learning software to locate and classify different road users from various types of motorised vehicles, distinguishing between those used for private use to heavy goods vehicles, pedestrians, or cyclists. From Cyclox's point of view this "measuring of travel modes has the potential to use technology to great effect, giving real time information about pedestrians and bikes, and motor traffic, which has huge potential for the city's transport". Generally, Cyclox's perception of innovation and digital data was practical and about increasing accessibility and

gathering data to support their arguments, rather than the possibilities of this innovation to transform the city.

In discussing the value and potential uses of this data and the already installed sensor grid, Cyclox was proposing the installation of a standalone digital display which would connect to this network and extract data to be used to spread messages in support of the reduction of motorised vehicle use, electric or otherwise. For example, information would be displayed that compares multi-modal travel time estimates to and through the city and the number of cyclists passing by, with the aim of "showing that cycling is faster and more efficient". In addition to this, there was also to be air pollution sensors installed and health statistics displayed, comparing the general health of cyclists and drivers. These displays were meant to shock and inform those traveling in, out, and through Oxford by car, "showing them [car drivers] the error of their ways", as I was jokingly told by one committee member. Yet, in a further meeting with the member who was spearheading this project, I was told that the "smart sensor system isn't working, it isn't identifying cyclists, and it isn't providing the type of data we [Cyclox] had hoped for". The 'type' of data that was hoping for was data that would provide the ammunition for Cyclox's arguments about road safety, reallocation of space, motorist behaviour, and give information on accurate numbers of cyclists riding past the sensors, none of which was felt to be possible at the time of this conversation.

What this shows is that there is comparatively less room for experimentalism when it comes to Cyclox's approach to smart urbanism as experiments can fail, they are costly, and the resulting technology may or may not support the city envisioned and experienced by Cyclox. In this way, technological development is not seen as something that should be tested and prototyped in a 'living lab' way, but as something to be mobilised and used to restore balance and provide support for the smarter goals and vision of Cycletopia. So, while the 'idea' of the Smart Detection System was still upheld as positive and commendable, the spending of the £10,000 and "waiting two years for these issues to be fixed" was not seen as a viable or desirable option. Here, the practical potential for technology was acknowledged as potentially valuable, but investing in something that would be heavily time and resource consuming would conflict with their ideas and preferred approaches to social and environmental relations and issues.

As seen in Cyclox's approach and their proposed, but ultimately abandoned, use and investment in technological innovation, the underlying and implicit understanding of being smart and creating a "city for people" was grounded in comparatively 'low-tech' social cohesion and infrastructural connection and continuity. For example, a common and frequently vocalised perception was the idea that owning or using an electric bike was 'cheating', appearing to be 'smart' by way of dishonesty and unfair advantage, as well as being tainted by association with regard to electric vehicles and charging stations. Here, the core tension revolved around the question of whether the motorisation of electric bicycles negates the physical benefit of cycling and the extent to which electric bikes should be conceptualised as 'motorised', such as mopeds or scooters. These issues spoke to a deeper tension over whether electrically assisted bikes betray the core values and ideals of the cycling community and their opposition to motor vehicle supporting smart traffic systems, and their general commitment to reducing said motorisation, electric or otherwise.

However, gradually, through interviews and discussions with committee members, I began to see an active attempt to address this bias, both within the committee itself and in the wider cycling community. This redressing of prejudice came in the form of arguing that those who use electric bikes still get an 'effective workout', where physical exertion is still required "95 per cent of the time", which meant that they were *not* like scooters or mopeds. Here, the argument in support of electric bikes was predominantly physical health focused and proposed that although cycling is electrically assisted, it is akin to "having a tail wind all the time" which enables the rider to cycle further and more frequently. This, then, would result in wider and more established access and connection to and around the city for all. Thus, staying true to, and facilitating, a future that is not dominated by autonomous traffic networks and electric vehicle infrastructure and charging stations.

To that end, Cyclox has obtained several electric bikes which they loan out to those wishing to 'see what they're like'. While this is not an official 'electric-bike sharing scheme', the purpose is to show that electric bikes are still bikes. In support of this, Cyclox has developed relationships with several electric bike providers, who attend the festivals and events that Cyclox takes part in, such as the Rose Hill Cycling Festival, and offer the public a chance to test the bikes and 'get a feel for them'. Not only are these bikes loaned to the curious, there is an active attempt to persuade City and County Councillors to borrow them, in the hope that

this will engender support for Cyclox's cause and notions of the 'right' kind of technologically supported and enacted future. Again, what this shows is that Cyclox is not 'anti-technology', rather, that their ideas of smarter futures are shaped by a distinct type of sociotechnical imaginary of the smart city; ones where digital data and technological mediation contribute to the materialisation of Cycletopia.

So, while my informants acknowledged digital technology, data, and technological innovation as valuable and important aspects of urban planning, heavy investment in technological innovation to address climate change was felt to be a misappropriation of public funds as "it doesn't make sense to wait for those types of solutions when investing in cycling and walking infrastructure is cheaper, more efficient, and is a reliable means of reducing carbon emissions and improving social conditions". This begins to show us that different rationalities and sociotechnical visions and values tend to have difficulty understanding the objections and justifications of other world views, especially when it comes to the underlying assumptions that inform their principles, strategies, and modes and content of public discourse.

Conclusion

In this chapter, I examined Cyclox's comparatively more eco-centric and community-based sociotechnical imaginary, which represents a counter-imaginary to Smart Oxford's officially endorsed smart city platform and narrative. This exploration allowed me to uncover counter ideas of smartness and smarter futures. Further, it provided the space to look at the context in which debates and tensions between official imaginaries and counter-imaginaries and their notions of how science and technology should be mobilised are embedded in the everyday. This chapter focused on the contested space and ownership issues that cyclists face in their daily lives as well as the strategies enacted by Cyclox to redress the perceived power imbalance throughout the city of Oxford.

Chapter 5 - Discussion

Only through the empirical study of actually existing smart city visions, programs, and practices can the complicated dynamic between the promises and practices of smartness in smart cities be further explored. This conclusion draws together and discusses my two case studies, comparing and contrasting their smart formulations and practices, exploring how that smartness is imagined and negotiated in official and counter imaginaries. Beginning the comparison, I will briefly remind the reader and revisit the visions that each group has of the future. This will also include a short discussion on mobility and the ways that each group approaches issues of congestion and what it means for future development. Following that I will look at ideas and mobilisations of access and connection, as these themes proved central to both groups, for different reasons and in different ways. Finally, I will conclude the chapter, and the thesis, by summing up the most salient points, followed an acknowledgement of the limitations of this study, and ideas for further research.

Organisational visions and subjective futures

As discussed in the literature review, sociotechnical imaginaries and systems are temporally and culturally situated; they are simultaneously products and producers of science, technology, and society. These imaginaries and systems not only develop attainable futures, they also demarcate them. Thus, while some sociotechnical imaginaries emerge as dominant at a given time, there are always others fighting and competing for materiality. Animate actors within these systems have the task of making sense of the intricate entanglement of social and technological processes and interactions around them. In this way, their ability to function and make these imaginaries manifest relies on the ability to create narratives and practices that lend coherence and legitimacy to the ways in which the 'game' is played (Geels 2002). Yet, not all actors have the same influence or ability to affect change and the relationship between actor groups, which plays a large part in the domination or subordination of imaginaries. As such, sociotechnical imaginaries are in a constant state of negotiation and contestation, where there will always be points of overlap and cooperation, but equally, there is always a source of tension and competition as actor groups create and play out their own narratives and futures.

This section will compare and focus on each of my groups' visions for the future, what they think things should and should not be, and how they imagine they might get there.

Each of my participating groups reflected distinct types of sociotechnical and urban imaginaries that were expressed in their urban visions and strategies, and in turn, these were reflected contested ideas and practices of smartness. These future expectations and aspirations, as imagined and constructed by social groups and institutions, occupy different temporalities and carry different interests and assumptions. Further, the future of science and technology renders the conflict over alternative visions of the future visible, as it provides a space that is actively created in the present through claims and counterclaims over its potential. As discussed in Chapter One, different actors and institutions, as they shape and are shaped by different sociotechnical imaginaries, find themselves competing for space and legitimacy across multiple societal levels and scales through real-time activities (Hess 2015; Jasanoff and Kim 2015; J. M. Smith and Tidwell 2016; N. Brown, Rappert, and Webster 2016a; E. Smith 2009).

As discussed in Chapter Four, throughout my time with Cyclox, the vision and mission of the community was constant and unchanging. Cycletopia, vision for the future of cycling in Oxford, was embodied in the values, norms, and practices of the community as they imagine and enact their vision of a smarter Oxford. The type of future that Cyclox advocates for, formally and informally, speaks to cyclists and pedestrians being prioritised socially and materially. Here, they emphasise that not only should cyclists be given full access to the city infrastructure, but that they should be prioritised in their right to navigate and engage with the city. This vision emphasises the current and future potential of a cycling city, where people cycle for economic growth, for health, inclusion and access, clean air, and carbon reduction. For Cyclox, tackling wicked problems, understanding and mobilising digital technology, and being smart are all animated by a deep commitment to community, equality, social wellbeing, sustainability. These ideals are symbolised in their vision of Cycletopia which is a representation of how they see the world, how it *ought* to be. This worldview also informs their sense making processes and practices, reflecting a shared understanding of the world, shared practices and discourses, and which shapes how Cyclox members build and experience the city. The Cycletopia imaginary galvanises the community and is the driving force behind the material and social Oxford they are attempting to enact as they navigate and negotiate their networks and connections.

For Cyclox, cycling is not just a mode of transport, it is not just an efficient and environmentally friendly way to get from point A to point B. Cycling is a way of life, it is unquestioned, it is part of the everyday that is considered mundane, taken for granted, and is not consciously thought about. Within this community, there is the deeply held conviction that cycling transforms (or has the potential to transform) society: socially, environmentally, and materially. As pointed out by one of my informants, "It's not about the bike", ideologically, "people do not just cycle because of the infrastructure"; they cycle because a space of mutual respect and trust exists between the users of that infrastructure, where there is an increased sense of social bonding, openness, respect, compassion, and tolerance among the cycling community. People can only cycle when there is interpersonal and institutional trust, and for this, social interaction is fundamental, which is at the very foundation of the cycling community.

Further, within this cycling ideology and its particular approach to the environment and the future, there is less room for experimentalism and prototyping in terms of testing proposed data-orientated solutions in real-time. This means that social and environmental equilibrium is easier to maintain, as opposed to the type of experiment-based future that Smart Oxford envisions and enacts, supported by prototyping and the search for disruptive technological platforms. For Cyclox, technological development is not necessarily seen as something to be experimented with in a 'living lab' way, as it is with Smart Oxford, but as something to be mobilised and used to restore balance and provide support for the smarter goals and vision of Cycletopia that address the immediate and imminent dangers facing the city if different futures win out.

Cyclox, their vision for and practices of Cycletopia, and their emphasis on equality, social cohesion, and physical access-for-all above all else highlights strong bonds of community, partnership, and feelings of strong group solidarity. This translates into a future that shapes and is shaped by ideals and practices of mutualism and equality. Cyclox is a community whose external boundary is strong, where there is a robust 'us vs them' mentality, and where blame tended to be lain at the feet of 'the system'. This observation is in line with research on comparatively more egalitarian communities, where there is the feeling that the world is unstable and under imminent threat, where experimentalism is not a rational response

as experiments can fail, and with the city in a state or urban crisis, failures are irreversible and costly (Hartmann 2012).

Unlike Cyclox, the vision of Smart Oxford is of a city where experimentalism and "innovative ideas, active citizens, and aligned stakeholders come together to co-create a better Oxford" ('About Smart Oxford' n.d.). Here, the future is envisioned as a place where technologies and people come together to collaborate and coordinate their efforts and resources to build a city that develops, deploys, and embodies new technologies to "enhance understanding of itself as a living, breathing community, and achieve understanding and consensus on how it should change to become equitable, sustainable, prosperous, and resilient" (Aldridge et al. 2015, 3). The vision is underpinned by respect for personal freedom and individual autonomy, where innovators and citizen-scientists are encouraged to develop ideas that are not only contribute to the public good, but are developed with the intention of selling that solution to other smart cities. For example, Oxford's issues of social deprivation are framed as ideal testbeds for smart solutions for communities in need, where digitally-led initiatives and organisations can develop, prototype, and deliver novel solutions that speak to issues of the inequality that can then be sold to other smart cities with similar issues. What this shows is that, in contrast to Cyclox's more community-based ethos and vision of the future, Smart Oxford's smart city is one where performance is highly valued and 'problem solving' becomes a competition for resources and efficiency.

In other words, Smart Oxford's vision, much like other neoliberal smart city imaginaries, is premised upon a particular narrative of urban crises, technological salvation, and individual innovation. This narrative can be seen in the internally circulated document on 'future-proofing' the city, as previously examined in Chapter Three, which further stated that city planning officers should prioritise and specify open standards for data and infrastructure, to ensure accessibility, compatibility and interoperability of city systems, and to maximise joined-up thinking and action across city services. What these ideas of smartness and connection highlight is a core tenet of Smart Oxford's smart city, where, as I was told by a board member in one of my interviews, "in the digital age . . . data and its infrastructure is the key, physical infrastructure needs to be built around it, not the other way around". As such, the development of smart applications, be they parking apps, air pollution detectors, wireless flood warning systems, or electric and autonomous vehicle networks are seen as the types of

technological projects that align with Smart Oxford's focus on supporting and enacting a smarter future through digitally and entrepreneurially driven innovation and know-how. Smart Oxford's fight to 'upgrade' the city and implement their version of 'smart' is driven by the need for change and transformation and jostles for legitimacy and support to make said changes.

The tension over the future imaginings, and how to get there, can be seen in many aspects of each groups' practices and understandings of the future. During my discussions with the Smart Oxford programme manager and various board members in interviews, when speaking of mobility and transport, sensor systems, autonomous vehicles, and traffic mapping are assumed the only 'logical' ways forward and there has never been any alternative offered or seemingly even thought about. Here, the uncritical acceptance of sensed smart transport is in direct conflict with Cyclox's fight for reduction of motorised vehicles, regardless of energy source or connection to smart sensors enabling the gathering of accurate traffic data. Cyclox and Smart Oxford are coming from distinctly different positionalities, where there is not one stable object or goal for the future, or one notion of how science and technology will or will not support that future.

<u>Smartness and congestion</u>

As seen in previous sections, the type of sociotechnical imaginary that shapes and is shaped by Cyclox's notion of the city and their understanding and mobilisation of technological development is often in direct opposition to the sociotechnical imaginaries of the smart city as envisioned and enacted by Smart Oxford. This sub section will mainly explore how each group mobilises smartness in response to the environmental crises facing the city in the form of climate change and congestion. Here, the framing of the problem of congestion highlights, in large part, the tension between Smart Oxford and Cyclox, and it fundamentally shapes how they think about smartness and sensing for the wicked problem that is climate change.

As established in Chapter Four, Cyclox, reimagining the future of transport, mobility with and through the city, envisions a smarter and more efficient future is not one that is necessarily data-led or data-intensive. And while, until recently, this vision of the future has not been expressed with explicit reference to smart city rhetoric, their ideas and strategies for

enacting the future is animated by a distinct type of sociotechnical imaginary of smartness. This type of imagining is predominantly animated by a strong commitment to those within the group, both in social structure and practice, reflected in their focus on ideas of community, mutualism, and cooperation within the community. Cyclox's notion of the type of future they are fighting for is not Luddite, it is not anti-technology, but it does not smoothly map onto 'common' smart city exercises in efficiency or urban problem-solving techniques that get discussed by Smart Oxford.

This can be seen most clearly in their ideas and approaches to the physical infrastructure of the city with regard to mobility and congestion. For Cyclox, ideas and visions of easy and smart transport and movement are predominantly thought of in terms of people powered movement in and around Oxford. This vision and enactment of a better and smarter city is the very antithesis of the smart transportation proposed and practiced by Smart Oxford, which is data and technology powered. These transport futures and practices as they relate to the city's network of roads, cycleways, and pathways are not only contested, but they are also fundamentally at odds. Further, the tensions play out in contestations over the types of cities these groups envision, the stakeholders for whom these cities are being imagined, and appropriate points and modes of intervention.

The traffic and mobility visions and practices that Cyclox engage in and advocate for are diametrically opposed to the idea that the way to reduce congestion, pollution, and traffic is to invest in sensing systems for traffic mapping and management, autonomous vehicles, and electric vehicles and charging stations. These 'smart solutions', Cyclox argue, are not the 'answer' that they promise to be. Even if shared driverless vehicle systems are put in place (as is envisioned by the City Council), Cyclox argue that autonomous and electric vehicles will not adequately address issues of congestion and traffic. Additionally, committee members stand emphatically behind the opinion that motorised vehicles—autonomous or electric, privately owned or shared—will continue to contribute to levels of particulate air pollution and particulate emissions that don't sufficiently tackle the issue at hand.

> . . . Perhaps a comment on electric cars should be included, particularly as the council seems to promote these . . . whilst electric cars are an improvement on the internal combustion engine, they still cause some pollution, traffic jams,

124

accidents, parking problems and vehicle dominated town centres . . . they are not the solution.

. . . the advent of the electric bike, however, makes short urban journeys by bike more practical for many more people and extends the distance over which cycling is practical for most people (email communication with a Cyclox member, 2019).

In direct contrast to Cyclox, Smart Oxford believes that the city's energy infrastructure needs prioritise and support the charging of these cars, not only to accommodate demand, but to contribute to the reduction of Oxford's carbon footprint. This is to accommodate the prediction that electric vehicles are expected to be '35% of global car sales by 2035'. Here, both Cyclox and Smart Oxford emphatically and steadfastly promote fundamentally opposing ideas and practices for reducing Oxford's environmental impact in the future, mobilising smart electric energy solutions in very different ways. This, again, renders visible sustained and deeply embedded opposition of notions in relation to Oxford's mobility and transport issues as they are now, and as they will be. This tension continues to highlight the competing sociotechnical imaginaries that are simultaneously imagined and practiced within the city.

What can be seen here is the conflict and tension between the underlying values and assumptions of different ideas and types of smartness in response to urban and environmental crises, from the entrepreneurially-led scalable innovation to be developed and sold, to the community-led guerrilla network, and the messy practices and projects that emerge as these ideas play out on the ground. This shows how these ideas and actual performances of smartness are in constant tension and negotiation, not only regarding the types of futures envisioned, but also in terms of the resulting inconsistent and messy real-time practice and engagement. Yet, it remains that for Smart Oxford's smart city, the future is one with an "integrated ecosystem where public sector organisations work with innovator to develop and deliver novel solutions to city challenges" such as "social deprivation, pollution, traffic, [and] flooding" (Smart Oxford and Hart 2019, 3). However, when those novel approaches come from different ideas and motivations, responding to different perceptions of risk and the environment, it is hardly surprising that visions and practices of the smart city are in negotiation for space, legitimacy, and the future.

Accessing and connecting to the future

During my fieldwork and post-fieldwork data analysis, I found that ideas and practices of access and connectivity—social, digital, and infrastructural—underpinned ideas of smartness and smarter futures. These themes of access and connectivity underlay the publicly performed visions of smarter, more sustainable, and more desirable futures within increasingly digitally mediated space. Each case shows how access and connectivity, in each case, although imagined and understood differently, might serve as the threads that tie the city together in ways compatible with different visions of Oxford. Even though the rhetoric, meaning, and enactment of 'access' and 'connection' reflected competing and incommensurate ideas of how the world works and what the future might be, these two groups shared the vocabulary of 'access' and 'connectivity'. Through access and connectivity, we begin to see the challenges of thinking about and practicing smartness. What we see is that on the ground these ideas are imagined, spoken about, and enacted in distinct ways. Different notions of access and connectivity show different ideas of *who* is supposed to participate, *which* stakeholders are meant to be engaging in the processes, and *how* ideas of innovation and technology are helping to bring about the sociotechnical imaginary that is, and will be, the city. Accessibility and connection reflect and reinforce competing sociotechnical imaginaries of the smart city, whereby different groups across the city engage with messy and disparate notions and activities of smartness. This analysis helps us to further understand that ideas of the smart city are not only contested, but that stable notions of the smart city are unlikely to emerge and fully crystallise regardless of context, or the force of the vision.

For Cyclox, accessibility and connection were about physical and social connectivity. For Smart Oxford, accessibility and connection were about digital and entrepreneurial notions of innovation. Further, for Cyclox, access and connectivity were something that physically connected streets and networks for cyclists, allowing for continuous routes which enable them to safely navigate the city. Equally, access and connection were also thought of in terms of imagining a cycling city that people could access and connect to in a way that maximally benefits the social good. For Smart Oxford, access and connectivity were about enacting a city where every citizen has access to resources and technologically enabled services and amenities,

developed by innovators and citizen scientists in an experimental and entrepreneurial smart living space.

Smart Oxford's type of smartness was about affording people access to technology that is implicitly assumed to have a positive impact. It is about bringing citizens into a smart city development loop by giving them access to resources and funding to develop these solutions, services, and products in a living laboratory which is a fluid and malleable space where everything is negotiable, and these concepts can then be commercialised and sold to Oxford as well as other smart cities.

Across the different meanings and practices of connectivity and access, ideas and plans for urban transit and traffic control illuminate the tensions between opposing sociotechnical imaginaries of the smart city. While Smart Oxford has a broader agenda than just transport and mobility, focusing on this particular aspect of smart urbanism allows us to see how these social and material contestations as they play out in Oxford. Thus, in this section, I will predominantly focus on ideas of 'smarter' transport networks, traffic management, and urban mobility. These approaches to traffic and transport are not just competing, they are fundamentally opposed, and it is unlikely that they will ever align. However, it is also unlikely that these different types of visions of smart transport will be exhausted or extinguished. To know what smarter transport is, one must also know what it is not. Each position will continue to be driven by the need to persuade, control, and perform Oxford's future. This is not to say that particular smart transport strategies and plans will not come to fruition at the expense of others. But it is to say that competing visions and ideas will remain, and those that hold to them will continue their attempt to crystallise these futures through practice.

Cyclox's visions and practices of access and connection in relation to traffic management and pollution are the very antithesis of the smart transport initiatives proposed by Smart Oxford, such as sensor networks, driverless vehicle networks, and the increased accommodation for electric vehicles. In their official response to the 'Introducing Oxfordshire 2050 Plan', Cyclox clearly stated that "in terms of smart technologies we do not see privately owned electric cars providing any solution to the problems of our roads. They continue to cause congestion and they cause particulate pollution". In committee meetings, when the hotly contested ideas of autonomous and electric vehicle networks came up, what was often

expressed was the local council's misguided investment in 'energy saving' electric vehicles and autonomous vehicles, which, according to the committee members, will only have marginal benefits at best. The sustainability and logic of this type of 'smarter' motorised future, and the current investment in that future was heavily contested. In other words, the smart mobility and transport as envisioned by Smart Oxford is not seen as 'smart' at all.

This is not to say that Cyclox is technophobic or anti-data. However, it is to say that the type of sociotechnical imaginary that Cyclox is orientated towards would see the idea of smart traffic meters and sensors as completely in opposition to what they are 'fighting for'. Here, Cyclox's notion of a smart city would not necessarily be digitally or technologically-led, it would be one where digital technology works in service of the access and connectivity in the physical infrastructure that they are advocating for. Further, the idea that you would invest in and install city-wide sensing projects, unacceptably diverts the much needed resources to build the physical infrastructure that Cycletopia imagines, as well as diverting investment away from the type of technological development that should support, rather than drive, smart urbanism and the desired urban experience. As such, Cyclox prioritises and fights for technologies to serve their idea of smarter futures through investment in the physical infrastructure of Oxford as it currently stands, opposing the allocation of funds for smart traffic sensors, driverless vehicle networks, and electric vehicle supporting cityscapes.

Cycling, as I was told on numerous occasions "is the answer to everything", directly challenging what Cyclox sees as the prevailing perception that electric vehicles and driverless sensor networks are 'the solution'. As one of my informants said, "You want a city for people, not for cars". What this shows is that built into this imagined smartness of Cyclox's was an overt expression of resistance to the imposed 'official' sociotechnical imaginary of Smart Oxford. Thus, given the antithetical relationship between Cyclox's vision and smart transport programs, it is unsurprising that when it comes to smarter traffic, supporting the development of more efficient vehicles, and sensed networks, Smart Oxford prioritises competitively developed technologically based traffic systems. Underpinning these priorities, there is the assumption that competition facilitates the creation of maximally efficient and beneficial 'smart solutions'. Here, smart parking apps, constantly improving wayfinding networks, multimodal journey planners and applications, and connected autonomous vehicle partnerships are seen as the types of technological projects that align with Smart Oxford's focus on supporting and

enacting a smarter future through digitally and entrepreneurially driven access and connection to and across the city.

Oxford's visions of access and connection to smarter transport systems are not just competing, there cannot be a full realisation of the city that Cyclox is advocating for *and* the city that is being envisioned by Smart Oxford. The distinctly contested sociotechnical imaginaries driving these visions are incommensurate, not simply different. This means that we can expect that there will always be tension in the way that the sensed city is imagined and practiced. (Douglas 2001). Indeed, institutions and imaginaries grow stronger and more coherent through opposition, with groups self-defining themselves against others (Douglas 2001).Thus, when we look at the different ideas and meanings of access and connectivity as explored in the chapter and the types of smarter futures that they contribute to, we begin to see that different visions and sociotechnical imaginaries of Oxford not only differ fundamentally in their values, attitudes, and practices, but that these differences strengthen each group's conviction and vision of what the future ought and ought not to be.

When we look at these notions of access and connectivity, and how my different participating groups imagined, discussed, and enacted them, we can see how these ideas framed these groups how they saw possibilities of intervention, each being distinct and contested. Not all of these ideas of access and connection were data-led, data-driven, or data intensive, but these distinct notions of access and connectivity show how digital data have in practice different instantiations. Drawing on the idea of what Brown, Rappert and Webster called future as contested social and material action (N. Brown, Rappert, and Webster 2016a), my research demonstrates that even relatively more stable concepts such as 'access' and 'connection' are contested in technological, material, and instantiated practice around data. What we see is that there are always contestations over what the city is and what it will be, and therefore, we should never expect a singular city to emerge, in either imagination or performance.

These possibilities of intervention manifested in very different understandings of smartness, the smart city, and what this brings to the future of Oxford. Thus, if we look at the underlying assumptions and logics of each of my cases, we can see that Cyclox, and Smart Oxford frequently exhibit particular and competing characteristics, behavioural patterns, and biases that impact how the future is imagined and how it is to be achieved. These deeply

embedded alternative ways of imagining and being in the world mean that it is unlikely that groups will fully align or unite under a predominantly uniform perception of the city. In practice, what this means, and what we can see, is that Oxford, as an amalgam of sociotechnical imaginaries, is pluralistic and in constant tension. This tension then emerges in the way the city is imagined, perceived, and experienced (Bridge and Watson 2003). As such, different Oxfords are imagined and enacted by different institutional perspectives, which also means that each institution and imagined future is unable to describe the 'whole', and the future can only be envisioned and practiced partially.

Chapter 6 - Conclusion

Drawing on the framework of the sociotechnical imaginaries and applying the lens of smartness, I look at the context in which debates over the role of science and technology in shaping the future manifest and become embedded in sociotechnical systems and everyday practice. Like urban and sociotechnical imaginaries, smart conceptualisations and practices are not fixed, nor do groups or individuals imagine and practice only one type, category of activity, or practice in what it means to be a smart city. In other words, across a city, we find that there are very different 'smart' ideas and activities going on, doing very different things in very different ways, propelled by different actors working towards different futures. To that end, this work looks at dimensions and productions of data and smartness and how it is imagined and mobilised by two separate and distinct local parties within the city of Oxford. I focused on hyperlocal discourse and practice to examine competing sociotechnical imaginaries of the smart city. This involved exploring one particular counter-imaginary as represented by Cyclox in conjunction with Oxford's official 'smart city' imaginary, endorsed by both the City and County Councils, as envisioned and practiced by the Smart Oxford Initiative. Each case study shows how smartness can shape and be shaped by the ideas and parameters on the ground and in different social domains in the same city. Further, each case attempted to use and deploy digital technologies in a different way to navigate the wicked problems that best the city. As such, how each group frames and imagines technology, and what they imagine it will do for them, is very different.

In more recent scholarship, social scientists have begun examining the smart city and what that means to citizens on the ground as well as the applications and realities of smart city projects. This has led to calls for studies, like mine, to empirically examine how and in what ways smart city notions and ideas are being realised in tangible, everyday spaces (see Wiig and Wyly 2016; Shelton, Zook, and Wiig 2015; Kitchin 2014c; Karvonen, Cugurullo, and Caprotti 2018). To know what smart cities are, they must be looked at in context and no two contexts are alike, as each case mobilises different practices with distinct meanings and ideas of the future. This work has begun to look at the interplay between citizen-led groups and notions of smartness and how that plays out in terms of imagining and enacting the future. This thesis

examined various themes that emerged from the fieldwork, themes such as access and connectivity, contested space, climate change and the environment, and digital transformation. These themes were present in both case studies, drawing them together but also setting them apart as different forms and performances of imagination were enacted and pulled through smart spaces in different ways in an effort to understand how smart cities are being imagined and realised. In this way, it follows that different groups construct their technological priorities according to their own types of sociotechnical vision of how those technologies can and should be mobilised to serve and enact a better future society (Burnham et al. 2017).

By looking at my organisations' approaches to access and connectivity, and how data and digital technologies may or may not work for those goals and futures, we can see that different attitudes and worldviews work together to produce and reproduce different sociotechnical imaginaries of the smart city. Examining access and connectivity in this way helps to isolate certain aspects of smartness in context and answers the calls for an increased focus on empirical observations of application in practice and lived experience of the smart city.

Further, with each group imagining and attempting to enact different smarter futures in the same geographical location, the dynamics of ownership and place-making then becomes apparent, bringing the reality of 'contested space' to the fore, as each group believes that their conceptualisations and practices are the ones that are maximally beneficial for society, for the economy, and for the environment. In this way, the city, its streets, its parks, any future developments, they all become sites of contestation, which embed themselves into everyday practice in the form of the fight for domination and legitimacy. In Cyclox's case, this comes mostly in the form of fighting for space, control, and authority on the roads, against motorised traffic and ideas of smart automated traffic networks and sensor systems. In Smart Oxford's case, it is the fight for funds and space to implement and test and innovative ideas, such as sensed networks and driverless cars, which will put Oxford 'ahead' of other 'smart cities'. Here, Cyclox's drive comes to the fore, where the goal is to create, in practice and policy, a healthier, more active, and open social streets and places, accessible to all, connecting people and places in continuous and harmonious ways through cycling and active movement.

Conversely, and much like Shelton and Lodato's work (2019), I found that Smart Oxford largely excluded the everyday citizen from participation in decision making processes, despite adopting 'citizen-centric' rhetoric. In this way, citizens were seen as data points to be mined for 'innovative ideas' to be tested and scaled up to be sold to other smart cities, but not necessarily to be included in the day to day running and maintenance of the 'smart' agenda. Once projects were deemed a 'success', like the Oxford Flood Network, they are left to continue running, where it is assumed that no maintenance or repair is required and that the project will continue on seamlessly. While this may work with projects such as MobOx, this assumption and lack of inclusion of Smart Oxford in the everyday life of the project also means that the average 'citizen' is not engaged in the day to day of Smart Oxford either.

As such, when we look at the different ideas and practices of each group, Cyclox and Smart Oxford, in terms of how they want to build and live in the city, and the types of smarter futures that they contribute to, we begin to see that different visions and sociotechnical imaginaries of Oxford differ in their values, attitudes, and practices. These differences strengthen each group's conviction and vision of what the future ought and ought not to be. Thus, smartness and smart cities may, in fact, be the products of contested and messy processes. This particular line of thinking begins to answer the scholarly call to look at existing smart cities as they are practices and played out, rather than focusing on idealised and unrealised smart imaginings. In this way, smartness occupies a space of plurality and variance, being many things to many people. By drawing on this notion and the distinct sociotechnical visions and practices of each of my groups, I argue that that there are multiple, contested, competing, and disparate 'smart' city visions and disparate meanings and modes of smartness. These different expectations shape the type of smartness being performed, so that it functions differently in different situations and across different settings.

Thus, this research builds on, and contributes to, contemporary scholarship examining smart cities as they are performed and applied in everyday life. Further, this avenue of inquiry calls for the reconceptualisation of smart cities and smart urbanism. Rather than the city being conceived of as knowable, manageable, and controllable through datasets and technological analysis, the approach to smart cities taken here shows how cities need to be framed and understood as fluid, multileveled, and contested assemblages, where city analytics need to be understood contextually and in conjunction with social experience and perception. In practice,

differences and contestations arise when competing visions hold to distinct assumptions, logics, goal specifications, and the means by which those goals are to be achieved. However, when speaking of contestation and tension, I am not speaking of all that can go wrong with the spread and integration of digital data and technology across the urban environment. Rather, I speak of how ideas and mobilisations of data and smartness are facilitated, stabilised, contested, and resisted in everyday imagining, practice, and social organisation.

This thesis was not about asking what constitutes smartness in Oxford. Rather, the focus here is on how different ideas and meanings of smartness reflect different visions of Oxford, as coproduced by different sociotechnical imaginaries of the smart city. This further shows the plurality of smartness within the practices and materialities of how the digital mediated city comes about and is imagined. Cyclox and Smart Oxford are coming from distinctly different positionalities, where there is not one stable object or goal for the future or how science and technology will or will not support that future. While each of my cases' visions and practices seemingly use the same vocabulary of access, inclusion, equality, and connectivity to convey smartness, they are conceptually homonymous, with their own meaning, set of embedded logics, and modes of engagement.

Smart Oxford plays on ideas of the neoliberal city and technological solutionism, they do this through the use of discourse that states that 'smartness' is able to solve these heretofore unsolved challenges. Built into this particular sociotechnical imaginary is an implicit faith in technological fixes and digital deployment. This implicit faith is supported by individualistic and entrepreneurially-led notions of urban growth. Here, smartness depends on being technologically and economically enabled, where the urban environment and imaginary is one that is marketable and able to be turned into a commodity. Further, Smart Oxford, demonstrating a strong affinity for individual freedom and autonomy, advocates for, and envisions, a future of competing innovations and entrepreneurially-led smart city solutions which mobilise issues of urban access and connectivity as opportunities for economic growth, while simultaneously working to 'solve' those challenges for the public good. This perspective led to the support and shaping of programs that prized performance very highly, where there is a drive to find projects and applications that would be best performing and of maximum value.

Conversely, the smartness that Cyclox identifies with and performs draws on community-based ideals and practices of social order and organisation, whereby, being smart means creating a city that understands and caters to the aspirations, interests, and needs, both current and potential, of all its residents equally, providing those residents don't want to drive. Demonstrating a strong commitment to egalitarian norms and values Demonstrating a strong commitment to egalitarian norms and values, Cyclox committee members believed that being smart, physically and materially, should mean equal and equitable access to public space, where social bonding is facilitated by the creation and maintenance of open and safe areas to congregate through the formation of low traffic neighbourhoods, and creating places and streets 'for people' and not for cars or transit. It was also suggested that the immaterial and intangible qualities of smartness should foster a kind of social bonding and belonging thought to be brought about by a strong cycling culture, where being smart means implementing policies and making decisions that improve and benefit the wellbeing of the city and those within the city by reducing environmental degradation, the city's carbon footprint, and increasing civic engagement and participation in the imagining and making of public space. Here, physical access to the city by way of cycle and pedestrian friendly public space, and the 'social freedom to meet and mingle on safe streets where children can play without undue risk from pollution or motorised vehicles' were seen as cornerstones of enacting smarter futures and enabling smarter choice. In this way, there was a strong link between moral and physical wellbeing and safety.

Overall, what this shows is that groups build legitimacy and strength on their own foundations of 'certainties' and ideas of what the city and the future should and should not look like. As such, my work examined the ways that different and competing imaginaries were framed, negotiated, and performed within Oxford, and in turn, shape how they think about smart technologies as being able to fit into their worldview and future. In other words, a data driven approach to the city is never neutral. We can see this in these two opposing counter narratives, and what each narrative says that data can offer and what these groups imagine they can do with the data. At this juncture, it is instructive to look back to the work by scholars such as Shelton et al. (2015), who map emerging and conflicting notions of data in urban space, highlighting that digital data and smart projects are always subjective and rarely unifying. Bringing this to bear on my research, we can see that the competition and tensions between my

cases are the result of engrained and divergent ideas of the future and different notions of the role and place of technological development in society.

What I found was that the vision of smartness and ostensibly data-driven efficiency outlined in the Smart Oxford roadmap was not universally compelling/accepted, and that different approaches to managing, sensing, and optimisation of urban networks and flows empowered and disempowered different actors and social relations, shaping ideas and approaches to technological change and innovation, as well as ideas of what the future ought to be. For example, as we have seen, Smart Oxford's vision, in line with other neoliberal urban imaginaries such as the entrepreneurial city, was based on ideas of urban crises, innovation, and technological fixes. Cyclox's counter-narrative, on the other hand, was framed by ideas of environmental fragility, risk, and technological scepticism. In a city that is increasingly digitally mediated, Cyclox responds to digital technology with suspicion and caution. Instead of turning to technological fixes, the 'smart' solution was believed to be behavioural and requires communal effort to 'change' the situation in a meaningful way. Here, smartness refers more to human action and practice, rather than innovative technological solutions.

What this confirms is that cities are not spaces of unanimity. By building on the scholarship of urban imaginaries, as discussed in the literature review, we can further see that cities are made and remade by way of complex and contested networks of interactions and negotiations, which result in competing images and experiences of the city that seek to give it distinct futures and identities (Cinar and Bender 2007; Estrada-Grajales, Foth, and Mitchell 2018; Amin and Thrift 2002). Thus, what I sought to explore over the course of this work were the circumstances that contribute to the production and reproduction of various types and notions of smartness and how those notions constitute and are constituted by distinct sociotechnical imaginaries. What I found were very distinct notions of smartness, practiced in very different ways, performed by different actors working for different ends. Each of my participating groups reflect distinct types of sociotechnical and urban imaginaries which were expressed in their urban visions and strategies, which in turn, reflected multiple and contested ideas and practices of smartness.

Overall, when we think of the smart city, we think about what various groups are hoping for when it comes to imagining and mobilising urban data. Yet, what Cyclox and other

grassroots social movements and political activist groups do with this data is very different and distinct to what more official groups like Smart Oxford, who share more 'techno-typical' smart city narratives, would use the data for. Not only that, but the very imagining of data, and notions about what it could and should do for the future, and how it should be mobilised are different for different types of groups. In this way, this work has explored smartness as it plays out in practice, and like data, smartness is never neutral nor objective, it is context dependent and can mean different things and manifest in different ways according to the type of imaginary being enacted and evoked.

Limitations

There were many limitations to this study, not least the embryonic and then relatively closed nature of the Smart Oxford initiative. When I first began to research smart cities, I had hoped that Smart Oxford would afford me an opportunity to observe and participate in a smart city programme from its inception to its functioning as a legitimised and main-streamed functioning. This was not to be. From the lack of funding, to the unclear leadership structure and support, it turned out that there was not enough of 'Smart Oxford' on its own to study. So, I introduced the counter imaginary element that I found in Cyclox. This gave me enough data to research the imagining and attempted realisation of sociotechnical imaginaries of smart cities, as I had two groups from which to now draw data.

That said, my work was further complicated by the fact that neither group had a full-time presence, as both were run by volunteers for the majority of my time with them. This meant that there was no permanent location from which to work out of, no location to visit and immerse myself in daily, and from where to conduct my ethnography. I overcame this by developing a close relationship with several informants from each group, interviewing all group and committee members, attending every meeting that was arranged, attending all events organised by each group, and gathering and analysing the documentation and literature available from each organisation.

However, this ethereal nature is, in and of itself, telling. At the beginning of my fieldwork, and in the pre-work conducting in scoping out Smart Oxford, there was every reason to anticipate that the movement around digital technology in the city would 'take off'. While

this absence made the fieldwork difficult to conduct, it in itself is also a research finding. The absence of movement but the presence of the 'talk' and smart discourse is a finding itself. It is, as I have shown, incredibly difficult to do ethnography in situations of 'failure' and while it may be a stretch to call Smart Oxford a 'failure', we have many examples of 'up and running' smart city initiatives but not as many examples of *how* digital technologies fail to mobilise, coalesce, and convene, where Smart Oxford is an example of the latter. Because of this, it is a useful case study in thinking through the limitations of smartness in the city. So, while this presented challenges to the data and my field site, it also presented a useful case for scholarship in examining cases where smart city ideals and imaginaries play out in a much messier and less straightforward manner than what particular visions and ideals would have you believe.

Further research

Initially, I had intended to look at the theory of distributed cognition, exploring whether or not the smart city was more than just a metaphor. I believe this is still a fruitful avenue to explore, however, Smart Oxford was not developed enough to provide the right access or data that was necessary to answer such a question. The potential for the material environment to support cognitive functions such as memory has long been recognised, but the material environment can be more than just a memory, it is an interconnected network of agents, both human and nonhuman, co-producing systems and process of distributed cognition (Hutchins 1995). In this way, the theory and application of distributed cognition posits that everyone and everything within a 'distributed cognitive system' shares an understanding of the types of thinking within that system, distributing and sharing the cognitive field into a network, with a set function, goal, and unitary outcome that connects all constitutive groups and materials.

At its core, this line of questioning would examine and investigate the relationship and interplay between smart cities, cognition, and cognitive systems. Briefly, distributed cognition looks at cognition on a systems level, where representations of the world are no longer solely mental or intracranial, they are transmitted through, and part of, various media, whether human, material, symbolic, or technical (Hutchins 1995).

When first introduced, the purpose of distributed cognition was to propose and develop a new branch of cognitive science, for which the unit of analysis includes external structures,

collectives, and artefacts that are organised as a system to perform a task (ibid). In this way, distributed cognition sees cognition as a product of embodied, extended, and enacted practice, and is reliant on manipulating representations within that system. In my case, my focus is on systems within and around the city. However, unlike the development of distributed cognition as exemplified by the idea of a cockpit (ibid), which is a system that has one set function, where all the cogs, so to speak, work toward one goal, and the system shares an understanding of ways of thinking, smart cities have no centralised node of what is or is not considered smart within the one system, in other words, there is no set function or singularly driven systems thinking as there is within a flight deck. Overall, this would involve examining different ideas of smartness (as embodied by smart city manifestations) and how they correspond to and rely on different ideas and theories of cognition, which subsequently shape and is shaped by social order and societal values.

Another possible line of inquiry lies in the application of Cultural Theory to the study of smart cities and sociotechnical imaginaries. Society, across all levels and scales, is pluralistic, where there exist different types of institutions which emerge from fundamentally opposed patterns of behaviour and ways of organising and seeing the world. Here, as understood by Cultural Theorists, different institutions structure their ideas about the natural and social world in ways that are compatible with the particular cultural orientation or worldview in which they find themselves at a point in time (see Douglas 2004, 2011; Gross and Rayner 1985; Thompson, Ellis, and Wildavsky 1990; Patel and Rayner 2015) Here, the idea would be to examine the role of tension and competition in pluralistic smart city visions. This would mobilise Cultural Theory to understand why there are different and conflicting imaginaries and how they continue to coexist, using tension as the core component through which to examine and study that continued coexistence of multiple and competing imaginaries. This particular avenue of research would rethink conflict, competition, and smartness as embedded in sociotechnical imaginaries. Drawing on Douglas' institutional approach to understanding social life and order, different imaginaries could be explored as reflecting fundamentally different worldviews, cultural biases, attitudes, and visions of the future.

These possibilities for future research are not mutually exclusive, there could be the application of Cultural Theory and radically extended cognition to the imagining and realisation of smart cities. Singular or multiple city case studies could be examined to provide

the necessary data as these theories and frameworks are scalable and could be applied at various levels of society.

Equally, coming back to the question of the contested nature of data in the city, there is much to be explored. Here, future research could focus on and explore contestation and negative examples of projects that do not manifest fully fledged smart city agendas, but become enthralled with the discourse. This thesis gives one such example and provides a fruitful case study of when those imaginaries do not actualise as they were intended. In this way, more of these case studies of smart city 'efforts' should be studied, to learn more of failure and how these negotiations around data occur. Throughout the course of my work, I found that smartness is something that is messy and subjective, there are no core tenets nor are there core smart values that apply across the board. So, perhaps, smart cities and smartness in general needs to be reimagined as something that is far more human and far more context dependent and subjective than has thus far been conceptualised.

References

'About MobOx'. 2014. *The Mobox Foundation* (blog). 13 March 2014. https://mobilityoxford.com/about-mobox/.

'About Smart Oxford'. n.d. Accessed 15 February 2018. https://www.oxfordsmartcity.uk/cgi-bin/about.pl.

Adler, Patricia A., and Peter Adler. 1987. *Membership Roles in Field Research*. Sage.

Aguilar, John L. 1981. 'Insider Research: An Ethnography of a Debate'. *Anthropologists at Home in North America: Methods and Issues in the Study of One's Own Society*, 15–26.

Aibar, Eduardo, and Wiebe E. Bijker. 1997. 'Constructing a City: The Cerdà Plan for the Extension of Barcelona'. *Science, Technology, & Human Values* 22 (1): 3–30.

Aldridge, Hugh, Andrew Baxter, Phil Clare, Tony Hart, Bill Imlah, Sebastian Johnson, Bryan Marhsall, Llewelyn Morgan, and Stuart Wilkinson. 2015. 'Smart Oxford: A Learning City for the 22nd Century'. Smart Oxford Project Board.

Amin, Ash, and Nigel Thrift. 2002. *Cities: Reimagining the Urban*. Polity Press.

Anderson, Benedict. 1991. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Verso.

Angelidou, Margarita. 2014. 'Smart City Policies: A Spatial Approach'. *Cities* 41: S3–11.

Appadurai, Arjun. 1990. 'Disjuncture and Difference in the Global Cultural Economy'. *Theory, Culture & Society* 7 (2–3): 295–310.

Arnstein, Sherry R. 1969. 'A Ladder of Citizen Participation'. *Journal of the American Institute of Planners* 35 (4): 216–24.

Ashworth, Gregory, and Mihalis Kavaratzis. 2009. 'Beyond the Logo: Brand Management for Cities'. *Journal of Brand Management* 16 (8): 520–31.

Bailly, Antoine S. 1993. 'Spatial Imaginary and Geography: A Plea for the Geography of Representations'. *GeoJournal* 31 (3): 247–50.

Bell, Daniel A., and Avner De-Shalit. 2013. *The Spirit of Cities: Why the Identity of a City Matters in a Global Age*. Princeton University Press.

Bernard, H. Russell. 2006. 'Interviewing: Unstructured and Semistructured'. *Research Methods in Anthropology: Qualitative and Quantitative Approaches* 21.

Bernard, H. Russell, and Harvey Russell Bernard. 2012. *Social Research Methods: Qualitative and Quantitative Approaches*. Sage.

Bijker, Wiebe E. 1997. *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change*. MIT Press.

Bijker, Wiebe E., Thomas Parke Hughes, and Trevor J. Pinch. 1989. *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. MIT press.

Bijker, Wiebe E., and John Law. 1992. *Shaping Technology/Building Society: Studies in Sociotechnical Change*. MIT press.

Bouzarovski, Stefan, and Mark Bassin. 2011. 'Energy and Identity: Imagining Russia as a Hydrocarbon Superpower'. *Annals of the Association of American Geographers* 101 (4): 783–94.

Bowker, Geoffrey C. 2005. *Memory Practices in the Sciences*. Mit Press Cambridge, MA.

boyd, Danah, and Kate Crawford. 2012. 'Critical Questions for Big Data: Provocations for a Cultural, Technological, and Scholarly Phenomenon'. *Information, Communication & Society* 15 (5): 662–79.

Bridge, Gary, and Sophie Watson. 2003. 'City Imaginaries'. *A Companion to the City* 2003: 7–17.

Brown, John Seely, and Paul Duguid. 2000. *The Social Life of Information*. Harvard Business Press.

Brown, Nik, and Mike Michael. 2003. 'A Sociology of Expectations: Retrospecting Prospects and Prospecting Retrospects'. *Technology Analysis & Strategic Management* 15 (1): 3–18.

Brown, Nik, Brian Rappert, and Andrew Webster, eds. 2016a. *Contested Futures: A Sociology of Prospective Techno-Science*. Routledge.

———, eds. 2016b. 'Introduction'. In *Contested Futures: A Sociology of Prospective Techno-Science*. Routledge.

Burnham, Morey, Weston Eaton, Theresa Selfa, Clare Hinrichs, and Andrea Feldpausch-Parker. 2017. 'The Politics of Imaginaries and Bioenergy Sub-Niches in the Emerging Northeast U.S. Bioenergy Economy'. *Geoforum* 82 (June): 66–76. https://doi.org/10.1016/j.geoforum.2017.03.022.

Burton, Kerry, Andrew Karvonen, and Federico Caprotti. 2018. 'Smart Goes Green: Digitalising Environmental Agendas in Bristol and Manchester'. In *Inside Smart Cities: Place, Politics and Urban Innovation*, edited by Andrew Karvonen, Federico Cugurullo, and Federico Caprotti, 117–32. Routledge.

Calzada, Igor, and Cristobal Cobo. 2015. 'Unplugging: Deconstructing the Smart City'. *Journal of Urban Technology* 22 (1): 23–43.

Caprotti, Federico, Robert Cowley, Ayona Datta, Vanesa Castán Broto, Eleanor Gao, Lucien Georgeson, Clare Herrick, Nancy Odendaal, and Simon Joss. 2017. 'The New Urban Agenda: Key Opportunities and Challenges for Policy and Practice'. *Urban Research & Practice* 10 (3): 367–78.

Cardullo, Paolo, and Rob Kitchin. 2019. 'Being a 'Citizen'in the Smart City: Up and down the Scaffold of Smart Citizen Participation in Dublin, Ireland'. *GeoJournal* 84 (1): 1–13.

Carvalho, Luís. 2014. 'Smart Cities from Scratch? A Socio-Technical Perspective'. *Cambridge Journal of Regions, Economy and Society* 8 (1): 43–60.

Chambers, Iain. 2008. *Migrancy, Culture, Identity*. Routledge.

Chourabi, Hafedh, Taewoo Nam, Shawn Walker, J. Ramon Gil-Garcia, Sehl Mellouli, Karine Nahon, Theresa A. Pardo, and Hans Jochen Scholl. 2012. 'Understanding Smart Cities: An Integrative Framework'. In *System Science (HICSS), 2012 45th Hawaii International Conference On*, 2289–97. IEEE.

Cinar, Alev, and Thomas Bender, eds. 2007. *Urban Imaginaries: Locating the Modern City*. Minneapolis: University of Minnesota Press.

County Council. n.d. 'Population | Oxfordshire Insight'. Accessed 11 April 2019. http://insight.oxfordshire.gov.uk/cms/population-0.

Cowley, Robert, Simon Joss, and Youri Dayot. 2018. 'The Smart City and Its Publics: Insights from across Six UK Cities'. *Urban Research & Practice* 11 (1): 53–77.

Craig, Robert T., and Karen Tracy. 1995. 'Grounded Practical Theory: The Case of Intellectual Discussion'. *Communication Theory* 5 (3): 248–72.

Crouch, Colin. 2004. *Post-Democracy*. Polity Cambridge.

———. 2016. 'The March towards Post-democracy, Ten Years On'. *The Political Quarterly* 87 (1): 71–75.

Cugurullo, Federico. 2018a. 'Exposing Smart Cities and Eco-Cities: Frankenstein Urbanism and the Sustainability Challenges of the Experimental City'. *Environment and Planning A: Economy and Space* 50 (1): 73–92.

———. 2018b. 'The Origin of the Smart City Imaginary'. *The Routledge Companion to Urban Imaginaries*.

Cyclox. 2014a. 'Cycletopia: A Vision for Cycling in Oxford and Surrounding Area'. Cyclox. http://www.cyclox.org/wp-content/uploads/2009/08/OXFORD-CYCLING-VISION_FINAL-v2_25-04-14smallpdf.com_.pdf.

———. 2014b. 'Cyclox Constitution and Rules'. Cyclox.

Dameri, R. P., and A. Cocchia. 2013. 'Smart City and Digital City: Twenty Years of Terminology Evolution'. In *X Conference of the Italian Chapter of AIS, ITAIS*, 1–8.

Daston, Lorraine, and Peter Galison. 1992. 'The Image of Objectivity'. *Representations*, 81–81.

Datta, Ayona. 2018. 'The Digital Turn in Postcolonial Urbanism: Smart Citizenship in the Making of India's 100 Smart Cities'. *Transactions of the Institute of British Geographers* 43 (3): 405–19.

Delina, Laurence, and Anthony Janetos. 2018. 'Cosmopolitan, Dynamic, and Contested Energy Futures: Navigating the Pluralities and Polarities in the Energy Systems of Tomorrow'. *Energy Research & Social Science*, Energy and the Future, 35 (January): 1–10. https://doi.org/10.1016/j.erss.2017.11.031.

Delina, Laurence L. 2018. 'Whose and What Futures? Navigating the Contested Coproduction of Thailand's Energy Sociotechnical Imaginaries'. *Energy Research & Social Science*, Energy and the Future, 35 (January): 48–56. https://doi.org/10.1016/j.erss.2017.10.045.

Dodgson, Mark, and David Gann. 2011. 'Technological Innovation and Complex Systems in Cities'. *Journal of Urban Technology* 18 (3): 101–13. https://doi.org/10.1080/10630732.2011.615570.

Douglas, M. 2001. 'Culture as Explanation: Cultural Concerns'. In *International Encyclopedia of the Social & Behavioral Sciences*, 3147–51. https://doi.org/10.1016/B0-08-043076-7/04657-X.

Douglas, Mary. 1986. *How Institutions Think*. Syracuse University Press.

———. 2004. *Natural Symbols: Explorations in Cosmology*. Routledge.

———. 2011. *In the Active Voice*. Routledge.

Durkheim, Emile. 1982. *The Rules of Sociological Method*. Edited by Steven Lukes. Translated by W. D. Hall. New York: Palgrave Macmillan.

———. 2013. *Durkheim: The Division of Labour in Society*. Edited by Steven Lukes. Macmillan International Higher Education.

Eade, John, and Christopher Mele. 2002. 'Understanding the City'. *Understanding the City: Contemporary and Future Perspectives*, 3–23.

Eaton, Weston M., Stephen P. Gasteyer, and Lawrence Busch. 2014. 'Bioenergy Futures: Framing Sociotechnical Imaginaries in Local Places'. *Rural Sociology* 79 (2): 227–56.

Estrada-Grajales, Carlos, Marcus Foth, and Peta Mitchell. 2018. 'Urban Imaginaries of Co-Creating the City: Local Activism Meets Citizen Peer-Production'. *Journal of Peer Production*, no. 11.

Feenberg, Andrew. 1999. *Questioning Technology*. Psychology Press.

Felt, Ulrike, Rayvon Fouché, Clark A. Miller, and Laurel Smith-Doerr. 2017. *The Handbook of Science and Technology Studies*. Mit Press.

Fiore-Gartland, Brittany, and Gina Neff. 2015. 'Communication, Mediation, and the Expectations of Data: Data Valences across Health and Wellness Communities'. *International Journal of Communication* 9: 19.

Gabrys, Jennifer. 2016. *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet*. University of Minnesota Press.

Gandy, Matthew. 2006. 'Urban Nature and the Ecological Imaginary'. In *In the Nature of Cities*, 78–89. Routledge.

Geertz, Clifford. 1973. *The Interpretation of Cultures*. Vol. 5019. Basic books.

Gibbs, David, Rob Krueger, and Gordon MacLeod. 2013. *Grappling with Smart City Politics in an Era of Market Triumphalism*. SAGE Publications Sage UK: London, England.

Giddens, Anthony. 1999. 'Risk and Responsibility'. *The Modern Law Review* 62 (1): 1–10.

Giffinger, Rudolf, and Nataša Pichler-Milanović. 2007. *Smart Cities: Ranking of European Medium-Sized Cities*. Centre of Regional Science, Vienna University of Technology.

Gitelman, Lisa. 2013. *Raw Data Is an Oxymoron*. MIT press.

Gitelman, Lisa, and V Jackson. 2013. 'Introduction'. In *Raw Data Is an Oxymoron*. MIT press.

Glaeser, Edward. 2011. *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier*. Penguin Publishing Group.

Glasmeier, Amy, and Susan Christopherson. 2015. *Thinking about Smart Cities*. Oxford University Press UK.

Goodspeed, Robert. 2015. 'Smart Cities: Moving beyond Urban Cybernetics to Tackle Wicked Problems'. *Cambridge Journal of Regions, Economy and Society* 8 (1): 79–92.

Graham, Steve, and Simon Marvin. 2002. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. Routledge.

Greenfield, Adam. 2013. *Against the Smart City*. Do projects.

Gross, Jonathan L., and Steve Rayner. 1985. *Measuring Culture: A Paradigm for the Analysis of Social Organization*. Columbia Univ Press.

Guest, Greg, Kathleen M. MacQueen, and Emily E. Namey. 2011. *Applied Thematic Analysis*. Sage Publications.

Guy, Simon. 2009. 'Fluid Architectures: Ecologies of Hybrid Urbanism'. *Technonatures: Environments, Technologies, Spaces and Places in the Twentieth First Century*, 215–37.

Guy, Simon, and Andrew Karvonen. 2011. 'Using Sociotechnical Methods: Researching Human-Technological Dynamics in the City'.

Haarstad, Håvard. 2017. 'Constructing the Sustainable City: Examining the Role of Sustainability in the 'Smart City'Discourse'. *Journal of Environmental Policy & Planning* 19 (4): 423–37.

Hacking, Ian. 2007. 'Our Neo-Cartesian Bodies in Parts'. *Critical Inquiry* 34 (1): 78–105.

Hartmann, Thomas. 2012. 'Wicked Problems and Clumsy Solutions: Planning as Expectation Management'. *Planning Theory* 11 (3): 242–56.

Hay, Colin, and Professor of Political Analysis Department of Political Science Colin Hay. 2007. *Why We Hate Politics*. Polity.

Hayano, David M. 1979. 'Auto-Ethnography: Paradigms, Problems, and Prospects'. *Human Organization* 38 (1): 99.

Head, Brian W., and John Alford. 2015. 'Wicked Problems: Implications for Public Policy and Management'. *Administration & Society* 47 (6): 711–39.

Herbert, Steve. 2000. 'For Ethnography'. *Progress in Human Geography* 24 (4): 550–68.

Hess, David J. 2005. 'Technology-and Product-Oriented Movements: Approximating Social Movement Studies and Science and Technology Studies'. *Science, Technology, & Human Values* 30 (4): 515–35.

———. 2007. *Alternative Pathways in Science and Industry*. MIT Press.

———. 2015. 'Publics as Threats? Integrating Science and Technology Studies and Social Movement Studies'. *Science as Culture* 24 (1): 69–82.

Hollands, Robert G. 2008. 'Will the Real Smart City Please Stand up? Intelligent, Progressive or Entrepreneurial?' *City* 12 (3): 303–20.

———. 2015. 'Critical Interventions into the Corporate Smart City'. *Cambridge Journal of Regions, Economy and Society* 8 (1): 61–77.

Hommels, Anique. 2005. 'Studying Obduracy in the City: Toward a Productive Fusion between Technology Studies and Urban Studies'. *Science, Technology, & Human Values* 30 (3): 323–51.

Hutchins, Edwin. 1995. 'How a Cockpit Remembers Its Speeds'. *Cognitive Science* 19 (3): 265–88.

Huyssen, Andreas. 2008. 'Introduction: World Cultures, World Cities'. In *Other Cities, Other Worlds: Urban Imaginaries in a Globalizing Age*, edited by Andreas Huyssen. Duke University Press.

Jasanoff, Sheila. 2004. *States of Knowledge: The Co-Production of Science and the Social Order*. Routledge.

———. 2015. 'Future Imperfect: Science, Technology, and the Imaginations of Modernity'. In *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, edited by Sheila Jasanoff and Sang-Hyun Kim, 1–33. University of Chicago Press.

Jasanoff, Sheila, and Sang-Hyun Kim. 2009. 'Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea'. *Minerva* 47 (2): 119.

———. 2015. *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*. University of Chicago Press.

Jasanoff, Sheila, Sang-Hyun Kim, and Stefan Sperling. 2007. 'Sociotechnical Imaginaries and Science and Technology Policy: A Cross-National Comparison'. *NSF Research Project, Harvard University*.

Jessop, Bob. 1997. 'The Entrepreneurial City: Re-Imaging Localities, Redesigning Economic Governance, or Restructuring Capital'. *Transforming Cities: Contested Governance and New Spatial Divisions* 46: 28–41.

Kaika, Maria, and Erik Swyngedouw. 2012. 'Cities, Natures and the Political Imaginary'. *Architectural Design* 82 (4): 22–27.

Kanuha, Valli Kalei. 2000. '"Being" Native versus "Going Native": Conducting Social Work Research as an Insider'. *Social Work* 45 (5): 439–47.

Karvonen, Andrew, Federico Cugurullo, and Federico Caprotti. 2018. 'Introduction'. In *Inside Smart Cities: Place, Politics and Urban Innovation*, edited by Andrew Karvonen, Federico Cugurullo, and Federico Caprotti. Routledge.

Kavaratzis, Mihalis. 2012. 'From "Necessary Evil" to Necessity: Stakeholders' Involvement in Place Branding'. *Journal of Place Management and Development* 5 (1): 7–19.

Kelley, Matthew James. 2013. 'The Emergent Urban Imaginaries of Geosocial Media'. *GeoJournal* 78 (1): 181–203.

Kim, Sang-Hyun. 2015. 'Social Movements and Contested Sociotechnical Imaginaries in South Korea'. *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, 152–73.

Kitchin, Rob. 2014a. *The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences*. Sage.

———. 2014b. 'The Real-Time City? Big Data and Smart Urbanism'. *GeoJournal* 79 (1): 1–14.

———. 2014c. 'Making Sense of Smart Cities: Addressing Present Shortcomings'. *Cambridge Journal of Regions, Economy and Society* 8 (February): 131–36. https://doi.org/10.1093/cjres/rsu027.

———. 2016. 'The Ethics of Smart Cities and Urban Science'. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 374 (2083): 20160115.

———. 2018. 'Towards a Genuinely Humanizing Smart Urbanism'.

Kitchin, Rob, Paolo Cardullo, and Cesare Di Feliciantonio. 2019. 'Citizenship, Justice, and the Right to the Smart City'. In *The Right to the Smart City*, 1–24. Emerald Publishing Limited.

Kitchin, Rob, Claudio Coletta, and Liam Heaphy. 2018. 'Actually Existing Smart Dublin: Exploring Smart City Development in History and Context'. In *Inside Smart Cities:*

Place, Politics and Urban Innovation, edited by Andrew Karvonen, Federico Cugurullo, and Federico Caprotti, 83–101. Routledge.

Kitchin, Rob, Justin Gleeson, and Martin Dodge. 2013. 'Unfolding Mapping Practices: A New Epistemology for Cartography'. *Transactions of the Institute of British Geographers* 38 (3): 480–96.

Kitchin, Rob, Tracey P. Lauriault, and Gavin McArdle. 2015. 'Knowing and Governing Cities through Urban Indicators, City Benchmarking and Real-Time Dashboards'. *Regional Studies, Regional Science* 2 (1): 6–28.

Kong, Lily, and Orlando Woods. 2018. 'The Ideological Alignment of Smart Urbanism in Singapore: Critical Reflections on a Political Paradox'. *Urban Studies* 55 (4): 679–701.

Kornberger, Martin. 2012. 'Governing the City: From Planning to Urban Strategy'. *Theory, Culture & Society* 29 (2): 84–106.

Kornberger, Martin, and Chris Carter. 2010. 'Manufacturing Competition: How Accounting Practices Shape Strategy Making in Cities'. *Accounting, Auditing & Accountability Journal* 23 (3): 325–49.

Lanier, Jaron. 2014. *Who Owns the Future?* Simon and Schuster.

Latour, Bruno. 1999. *Pandora's Hope: Essays on the Reality of Science Studies*. Harvard University Press.

Law, John. 1990. 'Power, Discretion and Strategy'. *The Sociological Review* 38 (1_suppl): 165–91.

Lee, Bill. 2012. 'Using Documents in Organizational Research'. *The Practice of Qualitative Organizational Research: Core Methods and Current Challenges*, 389–407.

Lefebvre, Henri. 1992. 'La Révolution Urbaine'. *Espaces Temps* 49 (1): 181–87.

Levidow, Les, and Theo Papaioannou. 2013. 'State Imaginaries of the Public Good: Shaping UK Innovation Priorities for Bioenergy'. *Environmental Science & Policy* 30: 36–49.

Lindner, Christoph, and Miriam Meissner. 2018. 'Introduction: Urban Imaginaries in Theory and Practice'. In *The Routledge Companion to Urban Imaginaries*, 1–22. Routledge.

Luque, Andrés, Colin McFarlane, and Simon Marvin. 2014. 'Smart Urbanism: Cities, Grids and Alternatives?' In *After Sustainable Cities?*, 86–102. Routledge.

Luque-Ayala, Andrés, and Simon Marvin. 2015. 'Developing a Critical Understanding of Smart Urbanism?' *Urban Studies* 52 (12): 2105–16.

MacKenzie, Donald, and Judy Wajcman. 1999. *The Social Shaping of Technology*. Open University Press.

Mair, Peter. 2013. *Ruling the Void: The Hollowing of Western Democracy*. Verso Books.

March, Hug. 2018. 'The Smart City and Other ICT-Led Techno-Imaginaries: Any Room for Dialogue with Degrowth?' *Journal of Cleaner Production*, Technology and Degrowth, 197 (October).

March, Hug, and Ramon Ribera-Fumaz. 2016. 'Smart Contradictions: The Politics of Making Barcelona a Self-Sufficient City'. *European Urban and Regional Studies* 23 (4): 816–30.

Mason, Jennifer. 2017. *Qualitative Researching*. Sage.

McFarlane, Colin, and Ola Söderström. 2017. 'On Alternative Smart Cities: From a Technology-Intensive to a Knowledge-Intensive Smart Urbanism'. *City* 21 (3–4): 312–28.

McLean, Anthony, Harriet Bulkeley, and Mike Crang. 2016. 'Negotiating the Urban Smart Grid: Socio-Technical Experimentation in the City of Austin'. *Urban Studies* 53 (15): 3246–63.

McNeil, Maureen, Michael Arribas-Ayllon, Joan Haran, Adrian Mackenzie, and Richard Tutton. 2016. 'Conceptualizing Imaginaries of Science, Technology, and Society'. Edited by Ulrike Felt, Rayvon Fouché, Clark A. Miller, and Laurel Smith-Doerr. *The Handbook of Science and Technology Studies*, 435.

Misa, Thomas J., Philip Brey, and Andrew Feenberg. 2004. *Modernity and Technology*. MIT Press.

Mitzschke, Andreas. 2017. 'Competing, Conflicting and Contested Futures: Temporal Imaginaries in the GM Crops Controversy'. In *Imagined Futures in Science, Technology and Society*, 91–113. Routledge.

MobOx. 2017. 'Oxford Living Lab'. *The Mobox Foundation* (blog). 11 May 2017. https://mobilityoxford.com/oxford-living-lab/.

'MoBox Living Lab'. 2017. *The Mobox Foundation* (blog). 11 May 2017. https://mobilityoxford.com/oxford-living-lab/.

Morgan, Llewelyn. 2018. 'Embracing Disruption'. In *Parking: New Ideas for Smart Cities. City Planning, Regulation and Policy*. https://www.newstatesman.com/sites/default/files/ns_bpa_supplement_feb_2018.pdf.

Mosse, David. 2006. 'Anti-social Anthropology? Objectivity, Objection, and the Ethnography of Public Policy and Professional Communities'. *Journal of the Royal Anthropological Institute* 12 (4): 935–56.

Nam, Taewoo, and Theresa A. Pardo. 2011. 'Conceptualizing Smart City with Dimensions of Technology, People, and Institutions'. In *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times*, 282–91. ACM.

Neff, Gina, and Dawn Nafus. 2016. *Self-Tracking*. MIT Press.

Neff, Gina, Anissa Tanweer, Brittany Fiore-Gartland, and Laura Osburn. 2017. 'Critique and Contribute: A Practice-Based Framework for Improving Critical Data Studies and Data Science'. *Big Data* 5 (2): 85–97. https://doi.org/10.1089/big.2016.0050.

Nesbitt, J. Todd, and Daniel Weiner. 2001. 'Conflicting Environmental Imaginaries and the Politics of Nature in Central Appalachia'. *Geoforum* 32 (3): 333–49.

Odendaal, Nancy. 2015. 'Getting Smart about Smart Cities in Cape Town: Beyond the Rhetoric'. In *Smart Urbanism*, 87–103. Routledge.

Okely, Judith. 1992. 'Anthropology and Autobiography : Participatory Experience and Embodied Knowledge'. In *Anthropology and Autobiography*, edited by Helen Callaway and Judith Okely, ASA monograph:1–28. London: Routledge.

Owen, David. 2009. *Green Metropolis: Why Living Smaller, Living Closer, and Driving Less Are the Keys to Sustainability*. Penguin.

Oxford Strategic Partnership. 2019. 'Oxford Strategic Partnership'. 2019. https://www.oxford.gov.uk/oxsp/.

Oxfordshire County Council. n.d. 'Oxfordshire Growth Board | Oxfordshire County Council'. http://www.oxfordshire.gov.uk. Accessed 4 October 2019. http://www.oxfordshire.gov.uk/residents/community-and-living/our-work-communities/oxfordshire-partnership/growth-board.

OxLEP. n.d. 'Oxfordshire Local Enterprise Partnership: Innovation Strategy'. OxLEP. https://www.oxfordshirelep.com/sites/default/files/uploads/OxLEP%20Innovation%20Strategy_0.pdf.

Parks, Darcy. 2019. 'Energy Efficiency Left behind? Policy Assemblages in Sweden's Most Climate-Smart City'. *European Planning Studies* 27 (2): 318–35.

Patel, Taran, and Steve Rayner. 2015. 'A Transactional Culture Analysis of Corporate Sustainability Reporting Practices: Six Examples from India'. *Business & Society* 54 (3): 283–321.

Peet, Richard, and Michael Watts. 2004. *Liberation Ecologies: Environment, Development and Social Movements*. Routledge.

Pinch, Trevor J., and Wiebe E. Bijker. 1984. 'The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other'. *Social Studies of Science* 14 (3): 399–441.

Polanyi, Michael. 2009. *The Tacit Dimension*. University of Chicago Press.

Porter, Theodore M. 1996. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton University Press.

Rayner, Steve. 2006. 'Jack Beale Memorial Lecture on Global Environment Wicked Problems: Clumsy Solutions'. James Martin Institute for science and civilization. https://www.scribd.com/document/258818064/Rayner-Wicked-Problems-clumsy-Solutions.

———. 2009. *Human Capital, Social Capital, and Institutional Capacity*. The MIT Press.

Ritchie, Jane, Jane Lewis, Carol McNaughton Nicholls, and Rachel Ormston. 2013. *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. sage.

Rittel, Horst WJ, and Melvin M. Webber. 1973. 'Dilemmas in a General Theory of Planning'. *Policy Sciences* 4 (2): 155–69.

Roche, Stéphane, Nashid Nabian, Kristian Kloeckl, and Carlo Ratti. 2012. 'Are "Smart Cities" Smart Enough'. In *Global Geospatial Conference*, 215–35.

Rose, Gillian. 2017. 'Screening Smart Cities: Managing Data, Views and Vertigo'.

———. 2018. 'Smart Urban: Imaginary, Interiority, Intelligence'. In *The Routledge Companion to Urban Imaginaries*, 103–12. Routledge.

Ruppert, Evelyn. 2018a. *Sociotechnical imaginaries of different data futures: an experiment in citizen data*. Erasmus University Rotterdam.

———. 2018b. 'Different Data Futures: An Experiment in Citizen Data'. In *The European Path towards Trusted Smart Statistics*. Bucharest: DGINS Conference.

Schelhas, John, Sarah Hitchner, and J. Peter Brosius. 2018. 'Envisioning and Implementing Wood-Based Bioenergy Systems in the Southern United States: Imaginaries in Everyday Talk'. *Energy Research & Social Science* 35: 182–92.

Shelton, Taylor, and Thomas Lodato. 2019. 'Actually Existing Smart Citizens'. *City* 23 (1): 35–52. https://doi.org/10.1080/13604813.2019.1575115.

Shelton, Taylor, Matthew Zook, and Alan Wiig. 2015. 'The "Actually Existing Smart City"'. *Cambridge Journal of Regions, Economy and Society* 8 (1): 13–25.

Smart Oxford. 2016. 'Future-Proofing for Smart City Developments'.

Smart Oxford, Author. 2015. 'The Smart Oxford Challenge – Innovative Ideas for Smarter Cities'. 10 December 2015. https://www.oxfordsmartcity.uk/oxblog/the_smart_oxford_challenge_innovative_ideas_for_smarter_cities/.

Smart Oxford, and Tony Hart. 2019. 'Smart Oxford Café Sci'. December 3.

Smith, Elta. 2009. 'Imaginaries of Development: The Rockefeller Foundation and Rice Research'. *Science as Culture* 18 (4): 461–82.

Smith, Jessica M., and Abraham SD Tidwell. 2016. 'The Everyday Lives of Energy Transitions: Contested Sociotechnical Imaginaries in the American West'. *Social Studies of Science* 46 (3): 327–50.

'Social Trends in Oxford | Oxford City Council'. n.d. Accessed 11 April 2019. https://www.oxford.gov.uk/downloads/file/2123/social_trends_in_oxford.

Söderström, Ola, Till Paasche, and Francisco Klauser. 2014. 'Smart Cities as Corporate Storytelling'. *City* 18 (3): 307–20.

Soja, Edward W. 2000. 'Postmetropolis Critical Studies of Cities and Regions'.

Stratigea, Anastasia, Chrysaida-Aliki Papadopoulou, and Maria Panagiotopoulou. 2015. 'Tools and Technologies for Planning the Development of Smart Cities'. *Journal of Urban Technology* 22 (2): 43–62.

Strauss, Claudia. 2006. 'The Imaginary'. *Anthropological Theory* 6 (3): 322–44.

Swyngedouw, Erik. 2009. 'The Antinomies of the Postpolitical City: In Search of a Democratic Politics of Environmental Production'. *International Journal of Urban and Regional Research* 33 (3): 601–20.

———. 2011. 'Interrogating Post-Democratization: Reclaiming Egalitarian Political Spaces'. *Political Geography* 30 (7): 370–80.

Tanweer, Anissa. 2018. 'Data Science of the Social: How the Practice Is Responding to Ethical Crisis and Spreading across Sectors'. University of Washington.

Taylor Buck, Nick, and Aidan While. 2017. 'Competitive Urbanism and the Limits to Smart City Innovation: The UK Future Cities Initiative'. *Urban Studies* 54 (2): 501–19.

Taylor, Charles. 2004. *Modern Social Imaginaries*. Duke University Press.

Thomas, Vanessa, Ding Wang, Louise Mullagh, and Nick Dunn. 2016. 'Where's Wally? In Search of Citizen Perspectives on the Smart City'. *Sustainability* 8 (3): 207.

Thompson, Michael, Richard Ellis, and Aaron Wildavsky. 1990. *Cultural Theory*. Routledge.

Thompson, Michael, and Aaron Wildavsky. 1986. 'A Cultural Theory of Information Bias in Organizations'. *Journal of Management Studies* 23 (3): 273–86.

Tidwell, Abraham. 2018. 'Morals in Transition Imaginaries and American National Identity Through Three Energy Transitions'. Arizona State University.

Tironi, Martín, and Matías Valderrama. 2017. 'Unpacking a Citizen Self-Tracking Device: Smartness and Idiocy in the Accumulation of Cycling Mobility Data'. *Environment and Planning D: Society and Space*, December.

———. 2018. 'Acknowledging the Idiot in the Smart City: Experimentation and Citizenship in the Making of a Low-Carbon District in Santiago de Chile'. In *Inside Smart Cities: Place, Politics and Urban Innovation*, edited by Andrew Karvonen, Federico Cugurullo, and Federico Caprotti, 183–99. Routledge.

Townsend, Anthony M. 2013. *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia*. WW Norton & Company.

Tozer, Laura, and Nicole Klenk. 2018. 'Discourses of Carbon Neutrality and Imaginaries of Urban Futures'. *Energy Research & Social Science*, Energy and the Future, 35 (January): 174–81. https://doi.org/10.1016/j.erss.2017.10.017.

Trencher, Gregory, and Andrew Karvonen. 2017. 'Stretching "Smart": Advancing Health and Well-Being through the Smart City Agenda'. *Local Environment*, 1–18.

Trivellato, Benedetta. 2017. 'How Can 'Smart'Also Be Socially Sustainable? Insights from the Case of Milan'. *European Urban and Regional Studies* 24 (4): 337–51.

Turner, Fred. 2006. 'How Digital Technology Found Utopian Ideology'. *Critical Cyberculture Studies* 257.

Urry, John. 2016. *What Is the Future?* John Wiley & Sons.

Vanolo, Alberto. 2014. 'Smartmentality: The Smart City as Disciplinary Strategy'. *Urban Studies* 51 (5): 883–98.

Vernooij, Eva. 2017. 'Navigating Multipositionality in 'Insider'Ethnography'. *Medicine Anthropology Theory* 4 (2): 34–49.

Viitanen, Jenni, and Richard Kingston. 2014. 'Smart Cities and Green Growth: Outsourcing Democratic and Environmental Resilience to the Global Technology Sector'. *Environment and Planning A* 46 (4): 803–19.

White, James Merricks. 2016. 'Anticipatory Logics of the Smart City's Global Imaginary'. *Urban Geography* 37 (4): 572–89.

Wiig, Alan. 2016. 'The Empty Rhetoric of the Smart City: From Digital Inclusion to Economic Promotion in Philadelphia'. *Urban Geography* 37 (4): 535–53.

Wiig, Alan, and Elvin Wyly. 2016. 'Introduction: Thinking through the Politics of the Smart City'. *Urban Geography* 37 (4): 485–93. https://doi.org/10.1080/02723638.2016.1178479.

Ybema, Sierk, Dvora Yanow, Harry Wels, and Frans H. Kamsteeg. 2009. *Organizational Ethnography: Studying the Complexity of Everyday Life*. Sage.