DETAILED DESCRIPTION

Introduction

Cities around the world are being rocked by an explosion in urban data. Real-time information linked to urban energy use, travel flow, personal location and movement, consumption, and criminal activity is bursting forth in the Global North and South. Local governments, along with corporate and academic partners, are enthusiastically working to leverage this 'big data' in order to improve the sustainability of cities and enhance the quality of urban life. This so-called *data-driven urbanism* uses high-powered computers and data analytics to generate objective knowledge about urban conditions, patterns and impacts that is used to inform urban policy and planning practices. Popular appraisals of data-driven urbanism have charted its transformative potential (Batty 2013; Townsend 2015). Critical appraisals have tempered this enthusiasm by highlighting the social and political domains at stake (Kitchin et al. 2017; Marvin et al. 2016). Both perspectives agree that data-driven urbanism is actively reshaping the contours of urban life. But both perspectives, to varying degrees, place the production of urban data itself in a 'black-box.' What remains to be fully explored, therefore, is the contents of this 'black-box': the complex assemblages of people, spaces, discourses and technologies that must be secured to produce urban data in the first place. Amidst its spreading application and widening influence, the question thus arises: **what types of practices and relations do we find when we open the 'black-box' of urban data and what role do these practices and relations play in data-driven urbanism?**

Research Objectives

This project seeks to deepen understandings of data-driven urbanism and develop new insights into the spatiality of urban politics by unpacking the 'black-box' of urban data in terms of its constitutive practices and spatial relations. To do so, the project will:

(a) Identify different practices of urban data production, processing and distribution currently being implemented in the Alberta urban context;
(b) Unpack these data production practices in terms of their spatial relations and arrangements;
(c) Examine the relationship between these practices and relations and the spread and influence of data-driven urbanism in the Alberta urban context.

Unpacking these 'black-boxes' will contribute to existing understandings of data-driven urbanism and its role in reshaping the contours of urban governance in Alberta and beyond. By placing data-driven urbanism in relation to the everyday practices that insure the objectivity, reliability, and authenticity of urban data, and by examining the kinds of spatial relations these practices engender, this project will illuminate the *socio-material* processes that underpin evidence-based policy opening up new spatial registers to critique and political contestation.

Research Context: Data-Driven Urbanism

Cities have taken centre stage in global debates regarding climate change, economic growth, poverty, public health and food security (Barnett and Parnell 2016). Increasingly, urban planning and policy responses to these problems are being articulated using the language of 'smart urbanism,' 'new urban science,' and 'big data' (Luque-Ayala and Marvin 2015; Townsend

2015). More often than not, however, the social and material practices that bring about urban data are bracketed off (White 2017; Bates et al. 2016). This is particularly conspicuous in discourses on smart urbanism and the new urban science.

Smart urbanism refers to the use of 'big data' to synchronize routine urban infrastructures and services with urban processes and needs in ways that improve the efficiency, equity and quality of life of urban citizens (Kitchin 2016; Luque-Ayala and Marvin 2015). Urban 'big data' itself is generated in a number of ways. Intelligent urban infrastructures (i.e. smart buildings, smart grids), equipped with digital monitoring technologies such as cameras, sensors, transponders, and meters, continually produce and send data to urban operating systems and control rooms where it is processed and responded to in real time. In addition, the everyday use of mobile technologies by urban citizens is harvested by mobile phone operators, social media sites, and emergency services, to produce real-time location, movement, and activity data. This deluge of urban 'big data' has revolutionized urban management systems. It has also rekindled interest in urban science, an interdisciplinary research field, harkening back to the 1960s, focused on the computational modelling and simulation of urban processes (Kitchin 2016; Shelton 2017). Drawing on theories of complexity science and leveraging the power of 21st century computing, urban scientists statistically mine big datasets in an effort to model the interactions, relations, and flows underpinning urban processes and to predict patterns of urban growth and change (Batty 2013; Batty 2012; Townsend 2015).

Together, these socio-technical practices and knowledge systems are fueling novel forms of *data-driven urbanism* (Batty 2012a; Marvin et al. 2015). For example, the proliferation of urban observatories that assemble, analyze and translate community data to generate useful intelligence for policymaking are stimulating forms of 'exploratory urbanism' (Caiaffa et al. 2013). The spread of urban laboratories that provide strategic learning environments for urban policy experiments are stimulating forms of 'test-bed urbanism' (Halpern et al. 2013). The multiplication of urban dashboards that collect and display urban data relevant to certain urban benchmarks or indicators are stimulating forms of 'stochastic urbanism' (Kitchin et al. 2015). The installation of urban operating systems that integrate the digital and material domains of the city are stimulating forms of 'computational urbanism' (Marvin and Luque-Ayala 2017).

From an urban historical perspective these forms of data-driven urbanism are not necessarily new; rather, they can be seen as a continuation of well-established practices of generating knowledge about the city and using it to formulate urban policies and plans (Legg 2007; McFarlane 2009; Rabinow 1995). Urban planners have experimented, since the early 20th century, with scientific methods, quantification, and rational planning with varying degrees of success (Barnes and Wilson 2014). Many techniques and forms of data used then – such as household censuses, mapping surveys, transportation studies, and administrative records – continue to inform urban decision-making today (Kitchin 2016). However, the volume, velocity, variety and resolution of 'big data' marks a significant shift in the scale (millions/billions of data points) and type of data (instantaneous, real-time) that are being used (Kitchin and McArdle 2016). Moreover, this surge in data combined with the expansion of computational power and the ability to respond in real time is producing forms of knowing and acting in the city – such as exploratory, test-bed, stochastic, and computational urbanism – that are qualitatively different from before (Marvin et al. 2015).

A number of scholarly perspectives has emerged on data-driven urbanism in recent years. Generally speaking, these perspectives have focused on the transformative nature of data-driven urbanism in terms of how urban life is seen, understood, and experienced (Batty 2012; Kitchin 2016; Marvin et al. 2016). On one hand, some recent scholarship has offered an applied perspective focusing on problems associated with data collection methods and their relevance with regard to the external validity of urban data (Kwan 2016). While critical in some ways this literature has still offered a relatively celebratory account of the prospects and potential of data-driven urbanism (see Townsend 2015).

On the other hand, an emerging body of scholarship has drawn on post-structural perspectives to advance a less flattering assessment of data-driven urbanism (Braun 2014; Gabrys 2014; Kitchin 2016; Lake 2017; Luque-Ayala and Marvin 2016; Marvin et al. 2016; Shelton 2017). This scholarship sees data-driven urbanism as much more than a sophisticated way of (re)representing the city: instead, data-driven urbanism is understood as a mode of government that actively reshapes the ontological contours of urban life in ways that make it more amenable to control (see Gabrys 2014; Luque-Ayala et al. 2014; Marvin et al. 2015). A primary target of this critique is the belief that "urban data can be unproblematically abstracted from the world in neutral, value-free and objective ways" and that "cities can be steered and managed through a set of data levers and analytics" (Kitchin 2016, 4). Critics charge that this realist epistemology "leads directly to a particular ontological position about what the city actually *is*" (Shelton 2017, 5). Specifically, this position reduces the world to an aggregation of discrete data points devoid of any context (Lake 2017), limits the role of governance, erodes the potential for urban democracy (Gabrys 2014), and depoliticizes urban injustices (Shelton 2017).

Both perspectives above invest considerable weight in the epistemic authority of urban data yet neither perspective has endeavored to fully unpack the social-material practices and spatial relations that must first be established to enact the realist epistemologies that are either celebrated or critiqued. Both perspectives, to varying degrees, leave the *epistemic geographies* that make possible urban data production in a 'black box.' By unpacking these 'black-boxes' and mapping the epistemic geographies that constitute urban data this project will speak to a shared lacunae in both perspectives.

Putting data-driven urbanism in its place in this fashion will call upon spatially orientated science studies literature (Livingstone 2003; Powell 2007; Reid-Henry 2010) as well as recent work in critical data studies (Bates et al. 2016; Kitchin et al. 2017; Ribes and Jackson 2013). The geographies of science literature has drawn attention to the 'placement of knowledge' and its role in the credibility and status of scientific objects and statements (Powell 2007). This literature has demonstrated how scientific knowledge claims are made by and through local and mundane modes of social and cultural interaction that establish the grounds of trust and credibility (Shapin 1998) and that these relations of trust, credibility and authenticity are situated in terms of the material and architectural surroundings of the inquiry (Gieryn 1999; Gieryn 2002). Following a similar track, science studies scholars such as Knorr Cetina (2007, 363) have focused attention on interiorized processes of knowledge creation – or "epistemic cultures," – consisting of "practices, arrangements, and mechanisms bound together by necessity, affinity and historical coincidence which, in a given area of professional practice, make up how we know what we know."

Complimenting this spatial focus and interiorized orientation is critical data studies (Bates et al. 2016; Kitchin et al. 2017; Ribes and Jackson 2013) which has focused attention on the socio-materiality of scientific practice. Drawing on the legacy of Actor-Network Theory (Latour 1999; Laws 2002) this literature has unpacked the social and material networks that constitute epistemic objects such as data and drawn attention to how these epistemic objects become a sort of actor themselves and shape the social worlds around them (Ribes and Jackson 2013).

Methodology: Placing Data-Driven Urbanism in Edmonton, Alberta

To open the 'black-box' of urban data production this project will utilize a comparative case study design to identify and unpack different examples of urban data production related to forms data-driven urbanism manifesting today in two Alberta cities (Edmonton and Calgary). Each case study will tell a story of the complex assemblages of people, spaces, discourses and technologies that must be enrolled and secured to successfully produce urban data. Subsequently, a comparative analysis will examine the relationship between these epistemic geographies and the spread and influence of data-driven urbanism in the Alberta urban context.

Alberta is an ideal study site to unpack data-driven urbanism through case studies of urban data production. In 2014, the Alberta Smart City Alliance – a cross-sector collaboration between community leaders, governments, corporations, entrepreneurs, and academics – was launched. Dedicated to the advancement of data-based solutions to complex urban issues the alliance has had manifested several issues at the local level. In 2017, the City of Edmonton (2017) released its 'Smart City Strategy' which endeavors to transform the City of Edmonton into an 'intelligent community' by working with government, citizens, industry and academia to leverage urban data, information and analytics towards three goals: resiliency, livability and workability. A total of nine different but overlapping streams has been identified (i.e. Citizens, Economy, Mobility, Education, Infrastructure, Environment, Community, Health, Open City). Furthermore, a number of initiatives has been implemented within each of these streams. For example, included among the city's Open City initiatives is the Open Data Portal which "provides citizens with access to trustworthy and usable datasets from the City's vast stores of municipal information," the Citizen Dashboard which "provides citizens with interactive access to current municipal service performance indicators," and Open Analytics which "showcases the City's programs which are leveraging analytics to improve outcomes for staff and citizens." These examples are indicative of forms of *stochastic* and *computational* urbanism currently spreading across Canada's urban landscape.

Initiatives such as these will provide the seed-bed for case study selection. The research project will involve three main phases. In **Phase 1**, Dr. Evans and student trainees will create an inventory of the smart city initiatives currently being implemented across Alberta and work to identify and compare practices of urban data production, processing and distribution they directly involve or rely upon (Objective 1). In **Phase 2**, Dr. Evans and student trainees will undertake two ethnographic case studies of urban data production, processing or distribution. Each case study will produce a thick description of the social-material practices involved in creating data (e.g. measurement, inscription, quality assurance, licensing, negotiation, and disclosure) and the socio-spatial relations (e.g. proximities, scales) that these practices engender (Objective 2). To create these thick descriptions, Dr. Evans and student trainees will embed

themselves within local contexts of urban data production using techniques such as document analysis, longitudinal interviewing, and participant observation. Embedding researchers within the actual applied contexts of urban data production will grant first-hand access to the complex assemblages of people, spaces, discourses and technologies that must be enrolled and secured to successfully produce urban data and, importantly, enact the realist epistemologies underpinning data-driven urbanism. Finally in **Phase 3**, Dr. Evans and student trainees will reflect upon the relationship between these *epistemic geographies* and the spread and influence of data-driven urbanism in Alberta (Objective 3). This analytical exercise will identify and describe the ways in which the socio-material practices and spatial relations that constitute urban data themselves condition the pathways and prospects of data-driven urbanism.