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Regionalizing the Infrastructure Turn: A Research Agenda

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Regionalizing the infrastructure turn: a research agenda

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ABSTRACT

An interdisciplinary 'infrastructure turn' has emerged over the past 20 years that disputes the concept of urban infrastructure as a staid or neutral set of physical artefacts. Responding to the increased conceptual, geographical and political importance of infrastructure – and endemic issues of access, expertise and governance that the varied provision of infrastructures can cause – this intervention asserts the significance of applying a regional perspective to the infrastructure turn. This paper forwards a critical research agenda for the study of 'infrastructural regionalisms' to interrogate: (1) how we study and produce knowledge about infrastructure; (2) how infrastructure is governed across or constrained by jurisdictional boundaries; (3) who drives the construction of regional infrastructural imaginaries; and (4) how individuals and communities differentially experience regional space through infrastructure. Analysing regions *through* infrastructure provides a novel perspective on the regional question and consequently offers a framework to understand better the implications of the current infrastructure moment for regional spaces worldwide.

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INTRODUCTION

These are auspicious times for social scientific research on urban infrastructure. An interdisciplinary 'infrastructure turn' is revealing the profound complexity behind infrastructural solutions to contemporary social problems (Anand, Gupta, & Appel, 2018; Dodson, 2017). The resurgent interest in infrastructural questions and the 'networked city' reflects applied and theoretical concerns across urban, regional and policy studies (Coutard & Rutherford, 2015; Dupuy, 2008; Graham & Marvin, 2001). Throughout cities and urban regions in the Global North, infrastructural systems – primarily understood as the material networks facilitating flows of people, goods, energy, water, waste and information – are leveraged by the proponents of neoliberal restructuring as adaptive spatial fixes and often become contested political objects. Such infrastructures are emblematic of alternative developmental futures: whether utopian imaginaries

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of smartness, efficiency, resilience and transformative governance or dystopian fantasies of failure and collapse (Marvin & Luque-Ayala, 2017; Monstadt & Schmidt, 2019). (Pipe-)dreams of the next infrastructural fix are juxtaposed with the realities of urban decline, austerity, everyday maintenance, and the task of dealing with the detritus of yesterday's spatial fixes (Kinder, 2016; Kirkpatrick & Smith, 2011).

At the same time, scholarship on and from metropolises in the so-called Global South is broadening our sense of infrastructural complexity and situatedness. In doing so, this work reveals how normative urbanization narratives from the Global North are disrupted by governments and residents via in/formal types of service provision (Lawhon, Nilsson, Silver, Ernstson, & Lwasa, 2018). Addressing infrastructural deficits in rapidly changing southern cities means 'understand [ing] the political economy of infrastructure availability, provision, expansion and potential access' in differing geographical and political environments (Simone & Pieterse, 2017, p. 39) and showing how infrastructures are (re)made on the ground in makeshift, hybrid and performative ways (Caldeira, 2017; Ranganathan, 2014). There are important distinctions between the infrastructural experiences of the Global North, South and East (e.g., Pilo, 2019; Schindler & Kanai, 2019; Shen & Wu, 2019), but seemingly distinct global conversations about growth and decline, connectivity and marginalization, investment and disinvestment are all grounded in the capacity of infrastructural systems to sustain our collective urban futures (Coutard & Rutherford, 2015; Filion & Pulver, 2019). In other words, infrastructure is a central element that makes the urban possible in its myriad forms; from the planetary reaches of extended urbanization to the concrete experience of urban life from Jarrow to Jakarta (Simone, 2019).

Calls to open the 'black box' of infrastructure proliferated during the first decade and a half of the 21st century (McFarlane & Rutherford, 2008). The urban infrastructure turn from the early 2000s took inspiration from science and technology studies, actor–network theory and critical geography to understand the politics of socio-technical systems; perhaps most prominently in the case of Graham and Marvin's *Splintering Urbanism* (2001). Now, an extensive literature is pushing beyond the boundaries of these agenda-setting accounts of splintering, (the collapse of) the modern infrastructural ideal and infrastructural intermediaries. Steele and Legacy (2017, p. 3) correctly note conceiving infrastructure 'as a multidimensional and lived phenomenon' has profound social, political and ecological implications: '[it] is as much about space, place, ecology and culture, as it is about pipes, scaffolding, wire and concrete'. Infrastructure presents a 'new optic field' through which we can examine the lived dimensions of urban society (Chattopadhyay, 2012) and the statecraft shaping contemporary forms of territorialization (Easterling, 2014). Urban infrastructures have been critically analysed to think through urban (geo) politics (Easterling, 2014; Schindler & Marvin, 2018; Sidaway & Woon, 2017), ecologies (Hetherington, 2019; Heynen, Kaika, & Swyngedouw, 2006; Malewitz, 2015; Monstadt, 2009), social relations (Siemiatycki, Enright, & Valverde, 2019; Young, Wood, & Keil, 2011; Zimmerman, 2001), and the affective experience of urban life itself (Amin & Thrift, 2017; Angelo & Hentschel, 2015; Graham & McFarlane, 2015).

Work emerging from the infrastructure turn has clearly impacted the study of cities and provided important conceptual tools for grappling with the production of urban space. However, in this paper, we argue that the fundamental *regionality* of the current infrastructure juncture demands further attention.

Regionalizing the infrastructure turn involves the complementary but distinct projects of applying a regional perspective to the infrastructure turn (thinking about infrastructure through the region) and engaging infrastructure as empirical and conceptual problematic to interrogate regional processes (thinking about the region through infrastructure). There is a creative tension between these projects, but the key point is that infrastructural regionalism can enhance either perspective as the infrastructure turn develops. As 'matter that enable the movement of other matter' (Larkin, 2013, p. 329), infrastructure both *exists* in space (as specific 'spatial products'

and more abstract and endemic 'infrastructural space') and *produces* space through their function as sociotechnical 'operating systems' (Easterling, 2014, pp. 11–14). The relational connectivity and modes of territorialization of infrastructural systems are implicit in recent thinking about our regional worlds (Allen & Cochrane, 2007; Schafran, 2014). The service and geographical demands of water, energy, communications and transportation systems mean urban infrastructures are policy domains that often form the basis of regionalism in practice, even as they function across fragmented governance arrangements (McArthur, 2018) or contingent 'infrastructural alliances' (Wachsmuth, 2017). Brenner (2004, p. 245) and Graham and Marvin (2001), for example, both identify distinctive regulatory periods of regional state spatial strategies, that is, from distributive spatial Keynesianism to the competitive neoliberal provision of selective premium infrastructural configurations. We call for regional studies to extend explicitly such conceptual and methodological techniques and construct a versatile comparative theory of regional infrastructures. Rather than examining regional infrastructures as distinct objects of analysis, we are interested in the *relations between* infrastructure and regions (each broadly conceived) and their capacity to effect new spatial imaginaries and political subjectivities. This paper charts a research agenda toward such a theory, one which is open to novel conjunctural (Peck, 2017) and relational modes of comparative research (Addie, 2016; Hart, 2018; Ward, 2010).

The argument is structured as follows. We begin by surveying (albeit selectively) the emerging institutional landscape of infrastructure knowledge production to capture a snapshot of our evolving infrastructural moment. We then apply a regional perspective to the infrastructure turn and assert the contributions made at the intersection of urban infrastructure and regional studies. Finally, we lay out a research agenda for future scholarship on *infrastructural regionalisms* premised on: (1) interdisciplinary dialogues that critique how we study and produce knowledge about infrastructure; (2) explorations of collaborative and competitive governance that foreground how infrastructure is governed across or constrained by jurisdictional boundaries; (3) interrogating the construction of regional infrastructural imaginaries and the contested ways in which actors and institutions 'see like a region'; and (4) integrating political economic and experiential–affective perspectives to reveal the complexities of 'infrastructural lives'.

THE INFRASTRUCTURE TURN'S INSTITUTIONAL LANDSCAPE: PROJECTS, DEBATES AND HORIZONS

Infrastructure – as a focus of empirical research, an ontological disposition and a methodological orientation – has enables researchers to pose new questions about our contemporary urban condition. The result is both a vast and varied body of literature and the development of academic research networks bringing multiple institutions together across diverse geographical contexts. These include major nodes of infrastructure theorizing such as the Laboratoire Techniques, Territoires et Sociétés (LATTS) at University Paris Est, which continues to produce foundational scholarship on issues surrounding the politics of infrastructure, technology and networked territoriality (e.g., Dupuy, 2008; Rutherford, 2020); large-scale global comparative research collaborations for which urban infrastructure is a central thematic concern, such as the Global Suburbanisms project (http://suburbs.info.yorku.ca/), and initiatives such as Mistra Urban Futures (https://www.mistraurbanfutures.org/en) that engage urban infrastructure as political and material terrains over which we can realize more just cities.

In this section, we survey several indicative research clusters, networks and projects to illustrate how the infrastructure turn is framed by, and institutionalized in, a new landscape of urban infrastructure knowledge production. These initiatives pose an impressively diverse range of questions and operate with divergent political orientations and research methodologies, but they all use infrastructure to explore widening socio-spatial rifts and inequitable urban growth dynamics. We identify five central characteristics of this evolving infrastructural moment.

First, current infrastructure turn compels *collaborative research that breaks down academic silos*. The Governing Urban Infrastructures project – a bilateral collaborative initiative between the University of Manchester and University of Toronto – exemplifies this orientation by functioning as an institutional vehicle for academics, practitioners and policy-makers to collaborate on urban infrastructure research. The coordinators of the Infrastructural Futures of Cities Across the Global North seminar project[1] argue that a multidisciplinary approach is essential to understand how such systems are governed and how they can support sustainable spatial development (Manchester Urban Institute, 2019). Comparably, the University of Cambridge's Infrastructural Geographies research group frames an agenda that looks 'Beyond the subdisciplines of urban, development, economic or political geographies [to] consider the ways in which state/citizen relations are framed and shaped by the material world' (Cambridge University Department of Geography, 2018). Transcending distinct academic approaches indicates the rich capacity for infrastructures to be marshalled to understand socio-spatial processes at the intersection of socio-cultural, ecological and political worlds, and to conduct comparative work in a global context.

Second, most infrastructural research initiatives adopt *an ecumenical definition of infrastructure*. We see the dynamic extension of infrastructure as a concept that includes both 'hard' (technical) artefacts and systems and intangible 'soft' (social) networks. For instance, the Research Group on Borders, Mobility, and New Infrastructures – based at the National University of Singapore in partnership with Max Weber Foundation – states '[o]ur notion of "infrastructure" is not limited to those physical forms that ground the movement of people, goods, and values across space and time, but also extends to those non-physical networks (e.g., social, business and cultural) that enable everyday processes of commensuration and evaluation' (National University of Singapore Faculty of Arts and Social Sciences, 2018). Using multi- and interdisciplinary approaches, alongside dynamic definitional parameters enables researchers, as the Cambridge Infrastructural Geographies group asserts, to examine infrastructure as an object of study, as a lens of analysis and as a tool for governance.

Third, renewed interest in the politics of infrastructure positions them as *the setting and stake of social struggle*. Governing Urban Infrastructures centres analytical attention on the socio-political contradictions inherent in globalized and localized agendas of infrastructure development. As with the Manchester–Toronto initiative, the Research Group on Borders, Mobility, and New Infrastructures confronts the role of infrastructures in connecting people and localities within shifting power configurations. The Infrastructure in Action research cluster based as the University of Sheffield's Urban Institute similarly seeks to understand 'how resources flow through the city and influence social disparities' and how 'their implications change through political and economic transformation, technological shifts and citizen mobilization' (University of Sheffield Urban Institute, 2019). These projects evince the mobilization of a normative political project that seeks to expose and address injustices and inequalities emerging at the nexus of infrastructure and urban development. Mistra Urban Futures articulates the struggle for just cities as a struggle over infrastructure that 'entails a fair distribution of resources and the opportunities to use them. This could be everything from food to health services and public spaces, as well as access to social networks' (Mistra Urban Futures, 2019).

Fourth, while monumental infrastructures, globalized modes of financialization and visceral struggles over access to vital resources draw much attention, several research initiatives are exploring *the pragmatic dimensions of infrastructure financing and upkeep*. Work conducted by the Infrastructure, Policy and Urban Worlds and Digital Infrastructures clusters at LATTS engages with both conceptual questions regarding the relations between city, technologies, and politics and applied concerns with the public policy implications of energy transitions and platform economies. The Maintainers – a global network of academics, practitioners, business leaders and activists interested in concepts of maintenance and infrastructure – capture the importance of recognizing 'the often hidden work done in repair, custodianship, stewardship, tending and caring for the

things that matter' (Festival of Maintenance, 2019). Also shifting from academic to applied concerns, the Foundational Economy Collective based in Wales place the demands of public infrastructure provision at the heart of their political manifesto, arguing 'the distinctive role of public policy is not to boost private consumption by delivering economic growth but to ensure the quantity and quality of foundational services' (Foundational Economy Collective, 2019). By examining how infrastructural services are provided and priced, their research can demonstrate how consequential investment decisions become to shaping access to resources and social opportunity.

Finally, many networks examine *the intersection of infrastructure and urbanization*. On one hand, this has spurred initiatives that use urban configurations and processes to explore infrastructural questions. Here, the Governing Urban Infrastructures project examines how tensions between infrastructure as an economic asset and infrastructure's broader social and environmental value are performed at the urban scale (Manchester Urban Institute, 2019). The Global Suburbanisms project offers an alternative cut by analysing multiple dimensions of infrastructure through a suburban perspective, following the logic that the urbanized perimeter is where the demand for new infrastructure is strongest and therefore, where its tensions, risks, and implications will be most acutely felt (Filion & Keil, 2017). On the other hand, variegated experiences of urbanization have prompted research agendas that embrace and problematize the infrastructural turn via a postcolonial critique of universalizing narratives abstracted from the Global North. The Heterogeneous Infrastructures of Cities in Uganda Project based at the University of Sheffield, for example, builds on African urban scholarship and knowledge co-produced with slum dwellers and their organizations to '[understand] the existing range of options that poor urban dwellers have created and fought for to improve services [and think] about the possibilities to transition towards universal services, but through a range of infrastructures, from networked to self-constructed' (Situated Ecologies, 2019). This approach embeds infrastructure within a broader project of southern critical urban theory (Lawhon et al., 2018). This project foregrounds the malleability of infrastructural systems in continually producing and disrupting 'cities-in-the-making' (Silver & Meth, 2018) and shows how infrastructures are open to appropriation and adaptation by individuals and communities in ways that are unanticipated by the formalized logics of urban administration.

The projects referenced above reflect international efforts to bring academics (and to some degree, practitioners) together to explore infrastructure as an intersectional concept linking the global to the local, the economy to social well-being, spatial power and disadvantage, and the monumental to the banal. The current infrastructure turn is developing a critical understanding of how infrastructures shape contemporary urban life, space, and place at multiple scales and in parallel locations. This academic (re-)awakening perhaps not coincidentally also corresponds to a moment of public debate about the role of infrastructure. The recent saga of Amazon's second North American headquarters (HQ2) (where one of the world's largest companies engaged 160 cities in a bidding war to decide where a new headquarters would be located) revealed just how important accessibility and connectivity were in both the leading bids and in the company's decision-making process. The looming spectre of climate change and progressive movements such as the Green New Deal also position infrastructure as a critical lever that must be more fully, thoughtfully, and critically exploited to effect spatial and behavioural changes. China's One Belt, One Road initiative demonstrates how state developmental strategies are leveraging massive infrastructure investments to reconfigure networked geographies for trade and patronage, raising broader questions about the political, environmental and cultural consequences of emerging infrastructural dependencies across the extent of the project. In New York, the localized issue of a tunnel repair on a single subway line (the L train) has raised equity concerns with respect to its impact on local communities, but also commuters from around the region, demonstrating how seemingly small projects can affect regional networks. Similarly, repairs required on a pair of rail tunnels under the Hudson River between New York City and

New Jersey threaten to disrupt commuting patterns in the metropolitan regions as well as cripple passenger rail across the entire Northeast Corridor (the urbanized region that stretches from Boston to Washington, DC).

Despite the attention being paid to the multi-scalar politics of infrastructure and the multidimensional facets of what such systems reveal, it is the *urbanity* of infrastructure and its role in the functioning of cities that appears as the primary empirical and theoretical entry point into the discussion. In what follows, we argue for the need to inject a distinct regional perspective into this predominantly urban infrastructural turn.

THE CASE FOR A REGIONAL APPROACH

Infrastructure development, maintenance and delivery may appear localized (Legacy, 2016), but it is crucial to recognize that they are almost always more accurately perceived as regional. That is, as urban infrastructure frequently transcends both local and national administrative boundaries, they operate at different scales than other urban processes, are embedded in different multiscalar regulatory spaces, and involve different regional constellations of actors (Enright, 2016; Harrison & Growe, 2014). While infrastructure represents the 'circulation space of the city' that consolidates the process of urban agglomeration (Scott & Storper, 2015, p. 8), it simultaneously grounds the arteries of global urbanization in new terrains of regionalized innovation and risk (Filion & Keil, 2017). This is an essential connection. The ways that infrastructures are mobilized by various stakeholders have always functioned as a prerequisite to the production of regional spaces beyond local boundaries (Erie, 2004; Gandy, 2003; Keil & Addie, 2015). The fact that many nation-states struggle to fund and maintain assets at the national scale is one of many reasons that regional lenses – from the city-regional to the supra-national and mega-regional – are gaining currency (Jonas, Goetz, & Bhattacharjee, 2014; Turner, 2018). Gaining a real understanding of the where, why, and significance of infrastructure on urban environments and everyday lives requires investigating regions, and how regionalisms and infrastructure interact.

Adopting a regional approach to infrastructure offers a series of vantage points and conceptual benefits that can enrich our understanding of a range of urban questions. This suggestion is not necessarily novel. In fact, many of the projects discussed in the previous section incorporate elements of a regional approach – whether by adopting a broad definition of what constitutes the city, mobilizing analyses over multiple scales or engaging with geographically extensive infrastructure projects. Yet, we contend there is significant utility in elaborating a distinct regional perspective on infrastructure and generating a research agenda that frames new strands of regional theory. We build the case for a regional approach to infrastructure on four propositions:

- *Cities are not regions*. Cities and regions offer distinct epistemological vantage points when thinking about infrastructure problematics. As spatial abstractions, they foreground different questions, challenges and fields of action even as debates around the urban and regional display increasing overlap and conceptual interchange (Soja, 2015). This goes beyond simple questions of geographical scale. Sassen provocatively argues focusing on the city-region as a strategic *analytical* scale brings urbanization patterns and economic competitiveness issues to the fore; highlighting questions of urban infrastructure, political collaboration and spatial structure in a manner that a focus on the (global) city does not (Sassen, 2001, pp. 80–82). Multiplier effects for infrastructural investment are calculated using a region as the denominator, while the 'operational landscapes' of large urban systems and inter-jurisdictional collaboration means infrastructural systems will often engage with complex governance arrangements that transcend place-based city politics (e.g., Enright, 2016). This is not to suggest city and region are mutually exclusive spatial frames through which we can engage infrastructure problematics. Rather, geographical scales (including the city and region) are

relationally constituted since they are: 'at once embedded within and shaped through broader interscalar architecture' (Brenner, 2019, p. 63). In the face of topological infrastructural networks, infrastructure's regionality foregrounds certain modalities of boundedness, territoriality, and political pragmatism at the same time as they enrich our understanding of multilevel, extra-regional geographies from the highly localized to the planetary and neo-colonial (Ranganathan, 2014; Schindler & Kanai, 2019; Wiig & Silver, 2019).

- *Infrastructure enables the development of regions*. Infrastructure functions both as a lens through which to understand socio-spatial and political-governance dynamics and as technologies that catalyse and crystallize these dynamics. How people define and experience their regions is, in part, the result of their infrastructural foundations. The persistent significance of infrastructure to regional development is evident historically and globally. For instance, the development of city-regions in the manufacturing belt of the United States was facilitated by investment in transportation infrastructures. Pittsburgh's role as a centre for steel production by the early twentieth century could not have occurred without the construction of railroad and canal infrastructure that facilitated expansion of the industrial suburbs into an integrated regional space spanning 30–50 miles along the region's river valleys (Muller, 2001). The geographical expansion of Los Angeles could not have occurred without the construction of highway infrastructure that was itself the consequence of negotiations between different professional constituencies including highway engineers, landscape architects and planners (DiMento & Ellis, 2016). By the 1990s, Malaysian Prime Minister Mahathir's goal to transform Kuala Lumpur into a global city-region was catalysed by development of a 'Multimedia Super Corridor' that connected the new Kuala Lumpur International Airport (KLIA) to the Kuala Lumpur City Center (KLCC) via new investments in transportation and communication infrastructures (Bunnell, 2004). In instances such as these, the construction of regions was enabled through infrastructures, and yet analytical frameworks to compare 19th-century Pittsburgh, 20th-century Los Angeles and 21st-century Kuala Lumpur through infrastructure remain elusive. What is apparent is that the ways infrastructure is produced, functions and decomposes are fundamental to the process of regionalization.
- *Infrastructure shapes how we define regions*. As Allen, Massey, and Cochrane (1998, p. 2) argued in their classic intervention *Rethinking the Region*, '"regions" only exist in relation to particular criteria. They are not "out there" waiting to be discovered; they are our (and others') constructions'. This compels one to ask how regions and their associated, divergent regionalisms are conceived, brought into being and experienced. Metzger concisely frames the task as hand in these terms: 'if the idea of the region as a "social construct" has become close to an axiomatic truth … how, by whom, and through what materials is it constructed in practice?' (Metzger, 2013, pp. 1368–69; cited in Parker & Harloe, 2015, p. 365). As both empirical objects of analysis and as a conceptual problematic, infrastructure discloses vital 'ways of being/becoming a "region"' or 'modes of regionality' (Paasi & Metzger, 2017, p. 27). They shape how territories are constituted as functional 'regional spaces' and rendered visible and governed as political 'spaces of regionalism' (Jones & MacLeod, 2004). A regional approach therefore territorializes the infrastructure–urbanization nexus, clarifying the physical and conceptual spaces that create implications for the current and prospective growth of city-regions through sprawl, debt, and planning.
- *Different constituencies are activated at the regional scale*. As in cities, the ability to create and claim regional space is contested, uneven, and unequal. A regional perspective offers an alternative frame to examine the question of agency in spatial and political terms – both at the macro- and micro-scales. The idea of the city as a 'multiplex' space (Amin & Thrift, 2002) becomes increasingly relevant for understanding the contested agency and diverging perspectives that confront planning for regional futures. That is, understanding how the

visions of different regional stakeholders are either enacted or ignored. For example, Jonas et al. (2014) describe how stakeholders in Denver's city-region managed to construct and maintain a coherent regional vision through constant negotiations between local economic and political stakeholders. This vision promoted investments in transportation infrastructure that ultimately created a new regional envelope for delivering intra-regional mobility. Elsewhere, different forms of city building occurred through land speculation and intra-urban competition that arose through local competition for infrastructural subsidies from the federal government (Dilworth, 2005). In both cases, regional futures were mediated by stakeholder visions for the region and catalysed by infrastructural opportunities. The heuristic of regional multiplexity therefore attends to the idea that different stakeholders will perceive the city-region differently because of their relative perspectives.

INFRASTRUCTURAL REGIONALISMS: A RESEARCH AGENDA

So how might we approach the task of regionalizing the infrastructure turn? While urban and (to a lesser extent) regional studies have a long tradition of exploring how regions construct infrastructure (Glass, Addie, & Nelles, 2019), we are particularly interested in thinking through the diverse ways that urban infrastructures make regions. Scholarship in the present infrastructure turn is acutely aware of how infrastructure establishes the materiality of urbanization and mediates the many lived dimensions of urban society. Regionalizing the infrastructure turn extends these insights to clarify how infrastructural decisions and structures influence the construction of the urban, and how these structures function at the regional scale. In this context we follow Deas and Hincks's (2017) call for heightened attention to be paid to the regional dimension of ostensibly non-regional spaces. This includes looking beyond a narrow focus on public/state-based actors' role in producing and territorializing regions through infrastructure (Harrison, 2014). It also recognizes that the structures and histories of regions themselves shape decisions about infrastructure development and provide important contexts within which the disruption or perpetuation of socioeconomic patterns occur.

We frame the analytical task at hand through the lens of *infrastructural regionalisms*. This lens animates a concern with fragmented, co-present, and overlapping nature of heterodox regionalisms (per Walks, 2013) and their impact on everyday life. The regional fabric that shapes how urbanization and urbanisms are constructed is mediated by investment and disinvestment in varied infrastructures (Knight, Sharma, & Sinclair, 2017; O'Brien, O'Neill, & Pike, 2019; Zimmerman, 2009). Infrastructures interpolate new regional spaces and new publics. Consequently, we propose a research agenda focusing on the questions of distributed agency, political action, and uneven development that emerge as infrastructures shape regions. This approach remains sensitive to the macro-scale dynamics driving the development of regional infrastructure to the individualized and collective processes shaping how regionalisms are manifested in the practical politics and lived experiences of specific city-regions. We put forward four themes that interrogate how regions are shaped through infrastructure and explore the implications of an infrastructural lens for theorizing regionalization and regionalism.

Interdisciplinary dialogues on regional infrastructure

As infrastructures have many dimensions, interdisciplinary dialogues are essential, in conceptual and methodological terms, to how we study and thus produce knowledge of infrastructural regionalisms (Beall et al., 2019). A key lesson drawn from across the infrastructure turn's institutional landscape is the need to engage scholars and practitioners working from a variety of disciplinary vantage points. DiMento and Ellis (2016) work on the history of highway infrastructure demonstrates the challenges to interdisciplinarity: specific traditions can gain purchase through

their tools or rhetoric, or because of their utility to policy creation. Avoiding capture by a single disciplinary tradition emphasizes the multiple perspectives from which the construction and reconstruction of infrastructural regionalisms represent.

Work on water governance by Karvonen (2011) in Seattle, Washington, and Austin, Texas, and Webber, Crow-Miller, and Rogers (2017) in China provide examples of why integrating multidisciplinary thinking on infrastructure issues matters. Tracing how governments use infrastructural solutions to manage urban water reveals how regional ecologies influence and are influenced by technical strategies and how infrastructure interventions both reflect and actively remake regional space. The overlaying of political, economic, social and ecological regionalisms in these cases stresses two fundamental points. First, infrastructure interventions reflect and actively remake regional geographies in ways that can only be grasped by leveraging multiple disciplinary perspectives, spatial grammars, and methodologies. Second, it is necessary to restate that cities are not regions. Critical urban studies provides an important set of political and intersectional orientations that regional studies and regional science would do well to embrace. But regional studies' established analytical strengths and contributions to policy-relevant scholarship offer an alternative discourse and set of intellectual parameters through which interdisciplinary debates can be marshalled – notably by providing a conceptual apparatus and range of problematics to explore how (infrastructure-led) regionalization 'is a purposive multi-authored process [that] is always prone to negotiation, calculation and the deployment or threat of force among and between its respective [territorialized] constituents' (Parker & Harloe, 2015, p. 365).

The imperative for interdisciplinary dialogues, however, also raises the need to grapple with the conceptual and practical challenges of working across intellectual silos. The growth of interdisciplinary engagements with urban infrastructure has considerably broadened its scope as an analytical concept and object of analysis. With this, the extended definitional capacity of technical and social infrastructures risks theoretical overextension and misuse (Howe et al., 2016). While we do not wish to impose a strict definition of 'infrastructure' given the richness of variegated research across the infrastructure turn, it is important to address the potential for infrastructure, regional or otherwise, to collapse as a chaotic concept. Interdisciplinary dialogues are not intended to realize a grand holistic synthesis of infrastructural regionalism but rather help one to theorize about the relations between diverse infrastructures and distinct regional spaces and processes. Such debates should serve to illuminate the ontological and epistemic limitations to interdisciplinary work: there are foundational tensions between how engineers and anthropologists engage infrastructure systems. The ontological bases of post-structural and critical political economy approaches are fundamentally contradictory (Brenner, Madden, & Wachsmuth, 2012; Keil & Addie, 2015). Interdisciplinarity is a necessary step in deepening our understanding of social and spatial dimensions of infrastructure systems, but it should not be an assumed theoretical or policy panacea. Bringing together engineering, political–economic, and experiential–affective discussions are valuable as a ground to interrogate the commonalities and contradictions emerging within the current infrastructure turn.

Infrastructure and regional governance

Regional politics must be to some degree territorially bounded and research should recognize processes of collective agency and decision-making (Glass, 2018; Keil, Hamel, Boudreau, & Kipfer, 2017). The regional restructuring of urban territoriality may be a pervasive global tendency, but reifying city-regions as coherent spatial and political units hides a multitude of sins: downplaying the complexities of managing intra-regional governance and the persistence of sub-regional competition and fragmentation (Henderson, 2018; Keil & Addie, 2015; Nelles, 2012). Adjusting our analytical lens to the regional level almost inevitability multiples the number of actors, organizations, and institutions implicated in infrastructure development, service delivery, and maintenance. Even if our focus is narrowed to a single type of infrastructure,

the potential remains for substantial structural and functional fragmentation: multiple agencies covering different territories and constituencies; the potential for different oversight regimes over each; and different interests involved in infrastructure financing, production, and advocacy. Indeed, Keil et al. (2017, p. 6) contend that in regions we clearly witness the limits of a 'purportedly rational quest for unity and collaboration [… running] up against the wildly chaotic and often sabotaging effects of various types of competition and political strife'. Regional processes are subject to ongoing and path-dependent negotiation, contestation, and subversion.

These dynamics are complicated because the contemporary construction of regions is occurring at scales not seen historically. 'Megaregional' spaces present new conceptual challenges for our capacity to evaluate how urbanization is unfolding in the contemporary era (Harrison & Hoyler, 2015; van Duijne & Nijman, 2019). For instance, the Yangtze River Delta region now includes over 150 million residents and 25 municipalities in an urbanized area spanning 99,600 km^2 (Li & Jonas, 2019). The way that vast infrastructural improvements and capital investment by the Chinese state is regionalizing this physical space represents just one part of the integration of a new regional space – infrastructural investment begets further changes to the way that space is perceived and conceived of by diverse publics within and outside the region (Li & Phelps, 2018). China's One Belt, One Road initiative reveals alternative *trans*national infrastructural regions that create bonds of cooperation and dependency at different scales. In Singapore, the historic dependence of that city-state on water imported by Malaysia via water infrastructures is being altered through the introduction of new technologies (Usher, 2019). The governing arrangements that function globally, such as standards for containerization, port infrastructures, and highways that facilitate regionalization at international scales. The way that new territorialities are introduced through the needs of trade and commerce frame bordering as a part of the geopolitical infrastructural governance milieu.

At the same time, Schafran's (2014) distinction between megaregional spaces and spaces of the megaregion shows that regional research must remain sensitive to what is achieved versus what is envisioned. Work on infrastructural regionalisms needs to be attuned to examining how multiple regional affairs are negotiated and organized through diverse formal and informal mechanisms. Analysing how diverse stakeholders coordinate interests and policies in and across regional spaces, and how these ostensibly localized processes are plugged into multiscalar and international nexuses can then not only help disclose the impact of infrastructure decision-making on communities but establish a geographically sensitive framework to understand how multiple governance scales converge and confound the operation of infrastructure (as the literature on infrastructure financialization helps demonstrate; e.g., O'Brien et al., 2019).

Seeing like a region

According to Scott (1998), to 'see like a state' means viewing the spatiality of politics through the territoriality of sovereignty. A world constituted by cohesive territories with claims to internal sovereignty emerges, in which subjects are beholden to the authority of a final arbiter – usually the national state – and disciplined by the arts of spatial governmentality. In contrast, several prominent scholarly interventions now argue that to 'see like a city' opens diverse political and sociospatial possibilities that themselves undermine appeals to territorial authority. Valverde (2011) frames this is a political project intended to expose the necessarily partial and incomplete nature of the state's governmental gaze. For Magnusson (2011), 'seeing like a city' presents a political world characterized by multiplicity, the presence of diverse knowledges, and a decentred web of politics 'in becoming'. Amin and Thrift (2017) alternatively 'see like a city' to present the urban as a vital, messy, machine-like infrastructural space – the city appears as a living thing built from the agency of numerous human and non-human actors that actively powers urban life.

The territoriality and relationality of regions defies simple transfer of either the spatial or ontological politics proscribed by seeing 'like a state' or 'like a city'. Both networked and place-based urban infrastructures engender the possibility to 'see like a region'. However, what might this mean in theory and practice? Finding coherence within the 'fuzziness' of regional space (Markusen, 2003; Peck, 2003) requires alternative techniques of spatialization and political modalities. Infrastructural systems – material or imagined – interpolate their own publics. This is at once immediately evident in the material infrastructures constitutive of the 'networked city'. As Höhne (2015) illustrates in relation to the opening on the New York City subway in 1904, new technologies created 'the passenger' as a new spatialized subject. The emergence of 'radical technologies' (Greenfield, 2017), digital disruptions (Barns, Cosgrave, Acuto, & McNeill, 2017) and platform economies (Ferreri & Sanyal, 2018) will continue to remake regional space and regional citizens. At the same time, place-based global infrastructures and mega-projects call into being contested and dynamic regional polities. The seismic tremors emanating from the competitive bidding for Amazon's HQ2 or radical geopolitical transformations of the One Belt, One Road initiative have produced and rendered visible new regional constellations that transcend the materiality of their infrastructural geography.

Therefore, we need to ask who can 'see regionally', what it means to 'see like a region', and how engaging with infrastructure issues shapes both regional imaginaries and regional 'sight'. For example, how does the construction of trans-boundary infrastructure create new regional imaginaries in and across regional spaces? How does the use and maintenance of water infrastructure in Malaysia to solve Singapore's water needs foment new forms of regional urban development in Malaysia? These questions are made more pressing by the accelerated (spatial and temporal) dynamics of contemporary urbanization, the suburbanization of race, poverty and vulnerability, the antiquated nature of previous eras' infrastructural fixes, and the unfurling ramifications of climate change (Keil et al., 2017; Turok et al., 2014).

Infrastructure and regional lives

Infrastructure and infrastructural regions are always in a state of becoming – but the ability to produce and claim them is both uneven and unequal. Indeed, infrastructures, and their regions, are experienced over variegated spatial and temporal frames in gendered, classed and racialized ways that shape the parameters of urban life and social reproduction (Bullard & Johnson, 1997; Siemiatycki et al., 2019). Butler (2014, p. 127) describes the demand for infrastructure as 'a demand for a certain kind of inhabitable ground' that can create new social and political movements that push for change. Rosa (2019) follows Butler's approach in examining the performative acts that a marginalized Roma population use to transcend limits to the sanitary infrastructure available to them. What emerges through these filaments is the tantalizing promise of how such infrastructural lives can construct new regional spaces for action and create a demand for more equitable planning and governance.

Amin and Thrift (2017) situate a vital politics of infrastructure as a necessary extension of the right to the city to address the 'cruelty' of machinic urban systems whose political economy determines life and death. This reality has distinct ramifications for the production, maintenance and governance of regional infrastructure, but also for how everyday small-scale interactions lay the foundation upon which broad socio-spatial structures are forms of meaning-making are founded (Angelo & Hentschel, 2015). Graham and McFarlane (2015, p. 2) call attention to how the everyday can inform our understanding of how urban infrastructures are produced, negotiated and contested via ways of knowing, barriers to access and modes of experimentation. In Simone's (2015, p. 375) terms, infrastructural lives disclose the ways 'People figure themselves out through figuring arrangements of materials, of designing what is available to them in formats and positions that enable them particular vantage points and ways of doing things.'

Applying a regional lens to this problematic reveals that regions, as frames for political activity from formal governance to everyday urbanism, look and function very differently relative to where they are viewed from: centre/periphery, city/suburb, points of connectivity/spaces of marginalization. The Bus Riders Union protests in Los Angeles during the early 2000s indicated that regional transit efforts to support light rail expansion into the region's wealthier suburbs was perceived as a positive outcome by political stakeholders and planning professionals who wanted to promote regional integration and a shift from automobility paradigms in greater Los Angeles (Grescoe, 2012). However, from the perspective of central city residents who relied on bus transit, the creation of rail infrastructure amounted to a racially biased and inequitable form of investment. Debates such as these indicate how infrastructural regionalisms need to be problematized by combining accounts of distributed agency with the different regional imaginaries that mobilize infrastructure as a leading material and discursive device. We draw inspiration from the work on urban aspirations in Southeast Asia by Bunnell and collaborators (Bunnell & Goh, 2018), which sought to evaluate the everyday imaginaries and inter-referencing that occurs across the region to address: (1) how regional infrastructure shape everyday life through the interpolation of regional subjects; and (2) how the infrastructural paradigms of privileged stakeholders are perceived by citizens in the city-regions that will be influenced by those plans, if enacted.

CONCLUSIONS

The fact that much infrastructure transcends the boundaries of local jurisdictions may, indeed, be reason enough to view infrastructure through a broader regional lens; one that has been less developed within the firmament of the current infrastructure turn. That the evolution of regional landscapes would not have been possible without infrastructural expansion is also a strong argument to carefully consider its role in shaping urban agglomerations. However, a regional approach to infrastructure holds value for a range of social science and policy disciplines in their efforts to decipher and explain urban phenomena, morphology, societies and institutions. We have argued here that concepts of 'the region' and of 'infrastructure' – in quotations here to acknowledge the wide range of things that each of these could mean – can function both as dependent and independent variables. That is, when trying to explain the shape, structure, functionality, or coherence of a region, infrastructure exerts important causal influence. Similarly, the location, type, decision-making and origin of infrastructure investment (among many other things) cannot be divorced from the socioeconomic and political landscape of a region, or its embeddedness in the institutional strata affected by formal institutions and global flows. Many of the important questions of urban, planning, and policy theory and research – posed by both academics and practitioners – would best be framed as regionally embedded, if not explicitly regional. What we are urging here is that future research have a deeper engagement with the emerging concept of infrastructural regionalism as a means of better understanding the consequences that current debates, investments, and inaction regarding infrastructure are having on the social, physical and economic dimensions of regional spaces worldwide.

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