Nikhil Anand
Akhil Gupta
& Hannah Appel
EDITORS

THE PROMISE OF INFRASTRUCTURE

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Nikhil Anand, Akhil Gupta, and Hannah Appel, editors

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INTRODUCTION

Temporality, Politics, and the Promise of Infrastructure

HANNAH APPEL, NIKHIL ANAND,
AND AKHIL GUPTA

The settlers' town is a strongly built town, all made of stone and steel. It is a brightly lit town; the streets are covered with asphalt, and the garbage cans swallow all the leavings, unseen, unknown and hardly thought about. . . . The town belonging to the colonized people . . . is a world without spaciousness; men live there on top of each other, and their huts are built one on top of the other. The native town is a hungry town, starved of bread, of meat, of shoes, of coal, of light.

—FRANTZ FANON (1961)

In April 2014, the Detroit Water and Sewage Department began to turn off the water of city residents who were behind on their payments. Over the course of the year, tens of thousands of Detroit inhabitants lost access to water in their homes, and fought furiously for its restoration. Also in April 2014, seventy miles north, the city of Flint, Michigan, switched its water source from Lake Huron to the Flint River. Polluted with the effluent from heavy industry and toxic bacteria, chloride and chlorine-based disinfectants that were intended to make the water drinkable only exacerbated the problem. Without additional chemicals to ensure that the first set of chemical additives would not disintegrate pipes, the treated river water corroded the aging plumbing infrastructure made of copper, iron, and lead. Heavy metals leached into municipal drinking water, resulting in widespread lead poisoning that was concentrated in children, as well as an outbreak of Legionnaires' disease.

Both the water cutoffs in Detroit and the new water source in Flint occurred at the order of a state-appointed emergency manager, tasked explicitly with austerity and given the authority to override elected officials. The role of the emergency manager is codified in law under Michigan's "Local Financial Accountability and Choice Act" (Act 436 of 2012: §9(2)). After a section ensuring the ongoing provision of services essential to public health, safety, and welfare,

the Act reads, "The financial and operating plan shall provide for all of the following: . . . The payment in full of the scheduled debt service requirements on all bonds, notes, and municipal securities of the local government, contract obligations in anticipation of which bonds, notes, and municipal securities are issued, and all other uncontested legal obligations" (§11(1)(b)). Debt servicing on infrastructure, in other words, openly superseded democratic governance. Residents of Flint brought bottles of brown water to city hall meetings and documented rashes and hair loss in children, only to be told repeatedly that the water was safe. The local General Motors plant had already stopped using city water in October 2014, citing concerns about corrosion. When the city council finally voted in March 2015 to reconnect to a safe water source, the emergency management team overruled the vote.

Detroit and Flint are predominantly black cities. Here, water infrastructure is a sociomaterial terrain for the reproduction of racism, which Ruth Wilson Gilmore defines as "the state-sanctioned or extralegal production and exploitation of group-differentiated vulnerability to premature death" (2007: 28). The racial necropolitics of Michigan show that infrastructure is a terrain of power and contestation: To whom will resources be distributed and from whom will they be withdrawn? What will be public goods and what will be private commodities, and for whom? Which communities will be provisioned with resources for social and physical reproduction and which will not? Which communities will have to fight for the infrastructures necessary for physical and social reproduction? In Detroit and Flint, the centrality of municipal debt, the privatization of public goods and services, and market-led governance might lead us to view both as typical examples of neoliberalism in practice. But in both cities, the water shutoffs were as much a result of longer struggles that date back to the 1930s as they were of more immediate pressures emanating from Wall Street (Cramer and Katsarova 2015). For example, one can trace differences in transport and utility infrastructures to the Federal Housing Authority's redlined maps that ensured racial segregation occurred within city limits (Highsmith 2015; Ranganathan 2016). The state-sanctioned infrastructural abandonment that ensued over the following decades is coded today as the product of financially irresponsible residents on whom austerity and dispossession can justly be visited. Indeed, part of Detroit's bankruptcy agreement was the quiet transfer of control of the municipal water infrastructure—serving a largely African American population and governed by their elected leaders—to a regional water board serving Detroit's suburbs. After five decades of deindustrialization and outmigration from the city, the water-board members were still 80 percent white.

Infrastructures around the world—from the United States to Fanon's Algeria to Palestine—offer archaeologies of differential provisioning that predate neoliberalism. Palestine, as Stephen Graham (2002), Eyal Weizman (2012), and others have shown, is a zone of infrastructural warfare, where water tanks, electricity transformers, roads, electronic communications, radio transmitters, and airport runways are often targets. And as the quote from Fanon with which we open this introduction suggests, the experience of infrastructure has long been an affective and embodied distinction between the settlers' town and the town belonging to the colonized people (see also Mrázek 2002; Barak 2013).

We start a volume on the promise of infrastructure here—in the United States, in Palestine, in colonial Algeria—to show the multivalent political trajectories of both infrastructure and the idea of promise. Material infrastructures, including roads and water pipes, electricity lines and ports, oil pipelines and sewage systems, are dense social, material, aesthetic, and political formations that are critical both to differentiated experiences of everyday life and to expectations of the future. They have long promised modernity, development, progress, and freedom to people all over the world. As deep-water rigs drill for oil in West Africa, as roads in Peru or Bangalore promise new connections, or as emerging economies rapidly build dams to modernize their agriculture, infrastructures are critical locations through which sociality, governance and politics, accumulation and dispossession, and institutions and aspirations are formed, reformed, and performed. At the same time as they promise circulation and distribution, however, these precarious assemblies also threaten to break down and fail. From the Deepwater Horizon conflagration to the Fukushima Daiichi nuclear-power plant, from the collapse of school buildings in China to the destruction in the wake of Hurricanes Katrina and Sandy, to the failure of the derivatives market in the 2008 financial crisis, infrastructural breakdown saturates a particular politics of the present. On the one hand, governments and corporations point to infrastructural investment as a source of jobs, market access, capital accumulation, and public provision and safety. On the other hand, communities worldwide face ongoing problems of service delivery, ruination, and abandonment, and they use infrastructure as a site both to make and contest political claims. As the black cities of Michigan or the rubble in Palestine forcefully show, the material and political lives of infrastructure frequently undermine narratives of technological progress, liberal equality, and economic growth, revealing fragile and often violent relations between people, things, and the institutions that govern or provision them. This tension—between aspiration and failure, provision and abjection, and technical progress and its underbelly—makes infrastructure a productive location to examine the

constitution, maintenance, and reproduction of political and economic life. What do infrastructures promise? What do infrastructures do? And what does attention to their lives—their construction, use, maintenance, and breakdown; their poetics, aesthetics, and form—reveal?

In recent years, cultural anthropologists have asked these questions of infrastructure. As a result, infrastructure is no longer invoked only as a conceptual tool, as, for instance, in Louis Althusser's (1969) famous invocation of infrastructure in theorizing capitalism, but as itself the object of ethnographic engagement (see Larkin 2013 for a helpful overview). This volume shows how oil rigs and electrical wires, roads and water pipes, bridges and payment systems articulate social relations to make a variety of social, institutional, and material things (im)possible. These "hard" infrastructures are classically anthropological subjects, because attention to them is also attention to sociality, to the ways infrastructure "attracts people, draws them in, coalesces and expends their capacities. . . . People work on things to work on each other, as these things work on them" (Simone 2012).

Infrastructure, like the state in an earlier theoretical moment, has often lurked in the background of anthropological research. Why the surge in contemporary interest? As Antina von Schnitzler asks, "Why infrastructure, why now, and to what end" (von Schnitzler 2015; see also Boyer, this volume)? To answer this question, von Schnitzler attends to the ways in which apartheid was enacted in South Africa through the differential management of infrastructure. Ethnographic attention to infrastructure reveals how politics not only is formed and constrained by juridico-political practices, but also takes shape in a technopolitical terrain consisting of pipes, energy grids, and toilets. An attention to infrastructure, von Schnitzler argues, is classically anthropological because it provides a frame to defamiliarize and rethink the political. Yet to recognize why infrastructure has emerged anew as an analytic and ethnographic object at this moment, we also need to attend to infrastructure's performance as a technology of liberal rule.

In his book *The Rule of Freedom* (2003), the historian Patrick Joyce demonstrates how the construction and management of infrastructure emerged as a key technology of government that was central to the performance of liberalism (see also Mitchell 2011). While privileging the circulation of people and things, infrastructures also served to permit states to separate politics from nature, the technical from the political, and the human from the nonhuman. Thus depoliticized, the management of infrastructures as a technical problem formed the grounds on which subjects were "freed" to participate in civil society and produce economic life. Infrastructures gave form to relations between

states and subjects on one hand, and corporations and capitalist circuits on the other. Infrastructures have continued to be central to the work of government since the nineteenth century, and as these opening references to the infrastructures of colonial Algeria, the contemporary United States, and Palestine demonstrate, this form of governance known as liberalism must always be understood, from its inception, as guaranteeing the liberties of some through the subordination, colonization, and racialization of others (Singh 2005; Melamed 2006; Sheth 2009; Mills 2011). Infrastructures have been technologies that modern states use not only to demonstrate development, progress, and modernity, giving these categories their aesthetics, form, and substance (Larkin, this volume), but also to differentiate populations and subject some to premature death (Fanon 1961; Gilmore 2007; McKittrick 2011).

As liberal modernity has (partly) shifted to neoliberal postmodernity, proponents of neoliberalism have argued that particular kinds of infrastructures are necessary to capitalism, and, as such, need to be continually produced (by states, corporations, or different combinations of these) to ensure the reliability of capital and labor flows. Today, as nation-states, particularly in the global South, seek to change their terms of integration into the global economy, they have undertaken dramatic infrastructure projects in varied financial and engineering relationships with private firms. Largely due to foreign investment in its infrastructure, the small central African country of Equatorial Guinea had the highest ratio of investment to gross domestic product of any national economy in the world in 2013 (Harrison 2013). In India, China, and elsewhere, governments see the construction of roads and telecommunication systems as being essential for the production of goods and services for markets as distant as North America and sub-Saharan Africa. The rapid construction of infrastructures in these nation-states is, in turn, shifting the geography of infrastructure expertise. Chinese and Indian companies can be found throughout continental Africa and South America, exporting labor, capital, and inputs like steel to build infrastructures far beyond their national borders.

The uneven flurry of infrastructural investment in the global South coexists with its mirror image in the United States and the United Kingdom, where neoliberal austerity regimes have withdrawn public funds for building and maintaining infrastructure. Such regimes subsist by wearing down the Keynesian investment in the roads, railways, water lines, sewage systems, and telecommunication systems of an earlier historical moment. In the absence of maintenance work on one hand, and neoliberal refigurations of infrastructure grids on the other, existing infrastructures have deteriorated to such an extent that they are breaking down more often (Bennett 2010). This moment has made

infrastructure visible in the global North in different ways. As Dominic Boyer argues in this volume,

> The Keynesianism that preceded neoliberalism, dominating western political economic theory and policy from roughly the mid-1930s until the mid-1970s, often utilized large-scale public works projects as key instruments for managing labor, "aggregate demand," and the affective ties of citizenship. Thirty years of privatization, financialization, and globalization later, this legacy of "public infrastructure" has become rather threadbare, capturing a general sense of evaporating futurity in the medium of corroded pipes and broken concrete. Of course, neoliberalism did promote aggressive investment and innovation in infrastructural systems necessary for the advance of financialization and globalization (not least telecommunications, the Internet, and transportation). At the same time, infrastructural temporalities look rather different from the perspective of the global South where . . . ruination is a constant companion of infrastructure. But across the global North, one cannot be faulted for feeling a creeping sense of decay spreading across many infrastructural environments. Thus, the turn to infrastructure could be viewed as something like a conceptual New Deal for the human sciences—a return of the repressed concerns of public developmentalism to an academic environment that has, like much of the rest of the world, become saturated with market-centered messages and logics over the past three decades.

Boyer encourages us to look beyond this nostalgia for petro-fueled Keynesianism, to see the infrastructural turn instead as part of the wider anti-anthropocentric turn in the human sciences. He takes the turn to infrastructure as a sign "that we are conceptually re-arming ourselves for the struggle against the Anthropocene and the modernity that made it," a provocation that we return to later in this introduction.

Within and beyond the histories of (neo)liberalism we describe, infrastructure is an integral and intimate part of daily social life: it affects where and how we go to the bathroom; when we have access to electricity or the Internet; where we can travel, how long it takes, and how much it costs to get there; and how our production and consumption are provisioned with fuel, raw materials, and transport. It is important to underline what may seem self-evident: infrastructures shape the rhythms and striations of social life. Class, gender, race, and kinship are all refracted through differentiated access to infrastructure, deciding whether water or electricity is available and to whom (Ferguson 2012). Who, in a given family or community, carries water from the stream or from a

communal tap into the home? Which families can afford a rooftop diesel generator? Cellular networks also reshape gendered socialities: daughters-in-law in Delhi may be allowed to leave the home but their movements are monitored by calls every few minutes; FaceTime and WhatsApp change forms of familial connection and communication at a distance. But even these insights provoke more questions than answers. Take electricity, for example: apart from the fact that people make illegal connections, we know very little of how electricity is actually used within homes. For what do people use electricity? What uses do they consider essential (Degani 2013; Kale 2014)? How is electricity integrated into people's daily lives, from homework for the kids to entertainment and leisure activities (TV, radio, computer, Internet, etc.)? Even as utilities and governments perceive a growing need to handle shortages and to imagine energy transitions, they know very little about daily use, daily need, and what might be socially possible. The promise of infrastructure, then, is multivalent. This volume indexes not only radical disconnection and abandonment, but also aspiration, the prospective, and futurity, of both infrastructures themselves and our work with them. We present a set of scholars working on infrastructure today, but we also gesture to all the work still to be done.

Of course, any given future is built on a past. The relationship between infrastructure, environment, and modernity has preoccupied anthropology since the beginning of the discipline. Cultural materialists like Leslie White (1943), Marvin Harris (1966), Julian Steward (1955), and even Marcel Mauss (2008) were critical of modernization stories of lag and lack, often told through gestures to the technological sophistication of what were believed to be discrete cultures. These theorists paid close attention to the ways in which irrigation, energy, and other technical systems mediated relations among local environments and labor and cultural practices. In his famous consideration of wet and dry irrigation technologies, for instance, Clifford Geertz (1972) drew attention to the ways in which these produced different kinds of persons and political authorities. Engaged with the work of Geertz, Stephen Lansing (1991) attended more closely to the "engineered landscapes" of irrigation in Bali, demonstrating how these infrastructure regimes transform and humanize nature, generating durable political institutions.

Newer work has further developed this engagement by attending to the ways in which environments and landscapes have to be remade so that infrastructures may behave according to human designs. Such projects to manage and order landscapes are always provisional achievements, dependent on the reliable performances of people and environments that are not always under the control of engineers and planners (Ballestero 2015). For instance, Ashley

Carse (2014) demonstrates how distant watersheds in upland Panamanian forests need to be continually made and extended as, in effect, the infrastructure of infrastructure, so that these deliver reliable quantities of water for the Panama Canal. As the materiality of the earth, the reliability of rain, and the political claims on the watershed are variable, the efficacy of the canal depends on the degree to which engineers, hydrologists, and politicians can consistently mobilize the water that it needs to work. Yet, to what degree might we expect nature to continue serving as infrastructure's infrastructure (Jensen 2017)? As humans intervene in the climatic, geological, and evolutionary processes of the Anthropocene (Chakrabarty 2009), both the effects and futures of modern infrastructuring projects appear increasingly tenuous.

This volume is indebted to earlier approaches in the field, not just in anthropology, but also in urban geography and STS. Thus, before turning to the three interventions of the volume (on time, politics, and promise), we schematically lay out an array of genealogies on which this volume builds: (1) critical Marxist perspectives from Althusser to Walter Benjamin, and the development studies literature they have influenced; (2) the government of difference in cities; and (3) the STS literature that attends to the practice of design and engineering. Part of the intervention of this volume, and the emergent anthropology of infrastructure of which it is a part, is to ask how these genealogies can be repurposed to new ethnographic, political, and theoretical ends.

Marxism, Development, and the Telos of Infrastructure

Seeking to account for the social and political changes brought about by the industrial revolution, Marxist and liberal theorists alike often deployed metaphors of infrastructure and technology to make their cases. Take, for instance, Marxist references to infrastructure in theorizing capitalism. In a famous passage, Althusser writes, "Marx conceived the structure of every society as constituted by 'levels' or 'instances' articulated by a specific determination: the infrastructure, or economic base (the 'unity' of the productive forces and the relations of production) and the superstructure, which itself contains two 'levels' or 'instances': the politico-legal (law and the State) and ideology (the different ideologies, religious, ethical, legal, political, etc.)" (1961: 134,). Althusser specifies that his invocation of infrastructure is a metaphor: "Like every metaphor, this metaphor suggests something, makes something visible. What? Precisely this: that the upper floors could not 'stay up' (in the air) alone, if they did not rest precisely on their base. Thus the object of the metaphor of the edifice is to represent above all the 'determination in the last instance' by the economic

base" (135). Althusser's famous metaphor of the edifice draws on the meaning of the prefix "infra" (below, beneath, or within) to make an argument about relative autonomy, reciprocal action, and determination in the last instance between infra- and superstructure.

Searching early writing in social thought for more literal accounts of infrastructure as a material form as opposed to a heuristic device, we note that infrastructure often appears as a temporal marker in the techno-developmentalist teleologies (Engels [1884] 2010) that not only animated Marxist approaches to capitalism and theories of economic modernization (Rostow 1960), but also played a similar role in early anthropological theory. For instance, in his attempt to place different cultures in a larger common humanity, Lewis Henry Morgan ([1877] 2004) saw technological development as the force behind cultural development, suggesting that changes in social institutions, organizations, and ideologies emanated from advances in technology. A culture's "arrival" at each progressive stage was marked by a signature technological achievement: fire, bow and arrow, irrigated agriculture, iron manufacture, and so on. Infrastructures and technologies here are both material and symbolic, standing in for a culture (or an economy's) development along a linear temporal scale. Within these now-dismissed theories of teleological progression, we can find the seeds of analytic insight. Take Benjamin's "Iron Construction F" from the Arcades Project. Even as he partakes in developmentalist ideas about the stage of civilization marked by iron, Benjamin also draws our attention to the indivisibility of the "politics and poetics" of infrastructure (Larkin 2013) and to the ways that materials are always "in the grip of dreams" (152) and come with "the peculiar and unmistakable dream world that attaches to them" (156). The tensile properties of iron permit it to be drawn into fantastic material formations: high-rises, arcades, and bridges; formations that celebrate a release from the earth and its histories, gesturing instead to a time and space oriented to the future.

In the late twentieth century, materialist approaches to development withered under poststructural critique, particularly in anthropology (Marcus and Fisher 1986; Gupta and Ferguson 1992). Anthropologists drew on the work of Michel Foucault to argue that material reality does not exist independently of or prior to representational practices. Discourses, narratives, and language give form to infrastructure as much as concrete, wires, or zoning regulations (Ferguson 1994; Escobar 1995). Anthropologists also drew attention to the multiple histories, geographies, and temporalities in relation to which states, infrastructures, and their developmentalist projects were situated (Gupta 1998; Nugent 2004). Nations and national development, as such, did not exist in empty,

linear time that was quantifiable by the state of the economy or its enabling technological milieu (Anderson 1983; Gupta 1998). Instead, polities are situated heterochronically, partly formed but not determined by infrastructures and governmental technologies they seek to proliferate (Chatterjee 2004).

Cities and the Government of Difference

While infrastructure itself has not always been a central analytic in the social sciences, systems and norms of distribution have long interested archaeologists, historians, anthropologists, and geographers. Distribution, of course, points indirectly to the ways in which infrastructures—roads, energy networks, and water systems—redistribute resources, form polities, and have political effects. Scholars of irrigation infrastructures, like dams and canals, for instance, have demonstrated how these works, while being constructed, displace millions of residents in order to redistribute resources to a relatively more powerful few (Kothari and Bhartari 1984). This approach has been especially well developed in urban geography, where scholars have built on Marxist approaches to the built environment, focusing on the production and differentiation of space, often in direct relation to capital. Infrastructure development, Colin McFarlane and Jonathan Rutherford (2008) point out, is fundamentally a political process. Infrastructure, like science, is "politics pursued by other means" (Latour 2012: 38). Stephen Graham and Simon Marvin (2001) take a Lefebvrian (1991) approach to urban space and infrastructure. In *Splintering Urbanism* (2001), they question the singularity, ubiquity, and taken-for-granted forms of infrastructures, urging us instead to attend to them as dynamic and congealed processes of organizing finance, knowledge, and power:

> A critical focus on networked infrastructure—transportation, telecommunications, energy, water, and streets—offers up a powerful and dynamic way of seeing contemporary cities and urban regions. . . . When our analytical focus centers on how the wires, ducts, tunnels, conduits, streets, highways and technical networks that interlace and infuse cities are constructed and used, modern urbanism emerges as an extraordinarily complex and dynamic socio-technical process. . . . As capital that is literally "sunk" and embedded within and between the fabric of cities, [urban infrastructures] represent long-term accumulations of finance, technology, know-how, and organizational and geopolitical power. (Graham and Marvin 2001: 8)

For Graham and Marvin, infrastructure is an assembly of sociotechnics, and cities are made through assemblies of infrastructure. But rather than thinking of distanced or aloof hardware networks, they invoke Raymond Williams's (1973) "structures of feeling" to note that infrastructures also give shape to and are shaped by quotidian human experiences and sentiments of hope, inclusion, violence, and abandonment.

To paraphrase Susan Leigh Star (1999), to study a city and neglect its sewers and power supplies, you miss not only essential aspects of distributional justice and planning power, but also dreams and aspirations, breakdowns and suspensions, and the intimate rhythms of how we wash or go to the bathroom, how we see in the dark or cool our food, and how we travel across space (379). If urban geographers have drawn attention to the material forms of infrastructure, and the ways in which they differentiate and structure urban life, anthropologists have attended more closely to the lived experience of unequal provisioning and differentiated belonging in cities (Caldeira 2000; Chu 2014; Schwenkel 2015a). City residents often push back against this differentiated belonging, making claims to social membership, political belonging, and rights to modernity in terms of infrastructure, whether imaginary, potential, or derelict (von Schnitzler 2013). Conversely, groups may identify everyday relationships with infrastructure marked by interruption, improvisation, and modification as a metonym of their marginality (Ferguson 1999; P. Harvey 2010; Anand 2017).

Consider a road infrastructure. Communities that are not connected to the nation-state by roads often see themselves as marginalized by its absence (Harvey, this volume). Inasmuch as roads are associated with development, improvement, and modernity, roads are sites of representation and aspiration (Coronil 1997; Larkin 2008). Yet while roads are desired by political subjects, they are not always used in the ways that state planners intend (Mrázek 2002). Before long, their designs are repurposed, altered, and populated by the heterogeneous dreams, desires, and practices that confound the goals and intentions of their designers (Scott 1998; de Certeau 2002; Mrázek 2002).

Critically, while anthropologists have been especially attentive to the heterodox lives formed by infrastructure in cities, they have also drawn attention to the flexible, provisional ways in which social networks step in when material infrastructures fail to deliver (Simone 2004; Elyachar 2010). Water pipes, electricity grids, and roads are always breaking down, need constant maintenance, and are regularly being claimed by groups authorized and unauthorized by city government. Moreover, marginalized others constantly make claims on and form infrastructures beyond those controlled by the state. In these ways, infrastructures are fundamentally social assemblies (Schwenkel, this volume). In

insisting we see "people as infrastructure," AbdouMaliq Simone (2004) draws attention to the ways in which social relations are a central, hidden, and vital support system necessary to live in cities. In what appears to some as the ruins of inner-city Johannesburg, a "highly urbanized social infrastructure" (Simone 2004: 407) enables people to improvise socioeconomic links with one another, providing what failed public services or formal-sector employment has not. To quote Simone, "Infrastructure is commonly understood in physical terms, as reticulated systems of highways, pipes, wires, or cables. . . . By contrast, I wish to extend the notion of infrastructure directly to people's activities in the city" (407). Elsewhere, Simone (2012) points out that the reticulated systems (on which this volume focuses) are themselves loci of people's activities, and they cannot be so easily dismissed as "merely" physical. As city employees and residents alike invest labor and care into everyday practices of maintenance and repair, they make more-than-human assemblies of infrastructure that are generative of differentiated materializations of rights, resources, and aspirations in the city.

Science and Technology Studies: Engineering Politics

Historians and sociologists of technology have been at the forefront of a larger turn toward infrastructure in the social sciences. In their influential work, Susan Leigh Star and Karen Ruhleder insist that "infrastructure appears only as a relational property not as a thing stripped of use" (1996: 113). Rather than being a singular thing, infrastructure is instead an articulation of materialities with institutional actors, legal regimes, policies, and knowledge practices that is constantly in formation across space and time (Ribeiro 1994; Mitchell 2002; Edwards 2003). Accordingly, infrastructures are seldom built by system builders from scratch. They are instead brought into being through compromised, improved projects of maintenance and repair (Mitchell 2002; Graham and Thrift 2007; Jackson 2014). They have histories and "grow" incrementally in a dynamic temporal, spatial, and political environment (Edwards et al. 2009: 369). They are formed with the moralities and materials of the time and political moment in which they are situated (Hughes 1983). Equatorial Guinea's national highway system and rapidly constructed gleaming buildings, for example, are very much of and in the time of oil extraction; they were built to announce the spectacular, if temporary, wealth of the petro-state to domestic residents and international visitors alike (Coronil 1997; Apter 2005; Limbert 2010; Appel 2012a, 2012b).

Emerging from the recognition that infrastructures grow temporally and incrementally, STS scholars have been particularly attentive to the emergent nature of expertise of those who manage, maintain, and extend infrastructures. Rather than assume that experts (corporate engineers, state officials, plumbers) possess an already formed expertise that they deploy to act and repair infrastructural problems, scholars have demonstrated how expertise and authority emerge from improvised, compromised heterogeneous practices that are performed amid partial knowledges and intransigent materialities (Law 1987; Bowker 1994; Harvey and Knox 2015). Infrastructures have no heroes or obvious system builders sitting in air-conditioned offices who bring them into being from a distance (Furlong 2014). Experts, often at their own admission, only have a partial knowledge of their working and are constantly compromised by the materialities and contingencies of infrastructure projects (Bowker 1994; Harvey and Knox 2015). Engineering expertise is made in the field, through efforts to repair and make infrastructures work again.

As such, sociologists of technology have attended to the labor of managing and maintaining infrastructure. Just as anthropologists might better apprehend the workings of the state by attending to the practices of lower-level governmental officials (Gupta 1998; Sharma 2008), Susan Leigh Star has urged scholars to focus on the very ordinary infrastructure workers, such as janitors and cleaners, who are otherwise unnoticed in everyday life (Star 1999: 386). These workers are vital to the everyday distributions and social life of infrastructure. Anthropologists have begun to follow Star's provocation. An attention to the practices of low- and mid-level administrators and technicians challenges any easy characterizations of technopolitics as exercised from afar (Anand 2017). Finally, STS scholars have also urged scholars of infrastructure to pay more attention to "those at the 'receiving' end of infrastructure"—those who are subjected to its distribution regimes and marginalizations in everyday life (Edwards et al. 2009: 371). As Edwards et al. ask, "How can claims on, through, and against infrastructure be formulated, organized, and heard? What constitutes adequate representation or participation in the process of infrastructural change and development? Under what conditions can rival interests in infrastructure (large and small, modest and profound) be acknowledged, addressed, and accommodated, in ways that enhance the legitimacy, appropriateness, and long-term efficacy of infrastructural change?" (Edwards et al. 2009: 372).

Anthropologists are well positioned to answer these questions through ethnographic studies of infrastructure. An attention to the materialities and socialities that are gathered to form infrastructures promise to both demonstrate

how these vital support systems are formed, and also how they bring other things into being and constitute social worlds (Ferguson 2012: 559).

In this volume, we draw together insights from STS, urban studies, and development studies to ask critical questions about how anthropologists study infrastructure. What happens when infrastructure is no longer a metaphor? What happens to theory making and ethnographic practice when roads, water pipes, bridges, and fiber-optic cables themselves are our objects of engagement? How do we take seriously the developmentalist fantasies and desires for modern infrastructure, often articulated by marginalized subjects themselves (Ferguson 1999)? A focus on infrastructure enables us to consider seriously the articulation (and disruption) between the technologies of politics and the politics of technology (Barry 2001; Anand 2011). By shifting our attention to infrastructures as ethnographic objects we promise new theoretical and political insight both for anthropology and from anthropology. Like Chakrabarty's (2000) provocation to "provincialise Europe," attention to infrastructure forces us to ask: What do we see differently and understand otherwise when we shift the analytic center? We see studies of infrastructure as a forceful reengagement with gender, race, colonialism, postcoloniality, and class on new empirical and political terrain. Infrastructure provides a site in which these forms of power and inequality are reproduced or destabilized, in which they are given form, occasionally obduracy, and often contingency. Precisely because all knowledge is situated (Haraway 1991), where we think from and what we think about affects what it is that we are able to think. Thinking from and with infrastructure allows new and productive decenterings and provincializations: space-time compression, for instance, depends on contested material and aesthetic choices; and liberal governance is no longer rationality at a distance, but politically intimate practices. And indeed these are the themes—time, politics, and promise—around which we organize the volume and the remainder of the introduction.

Time and Temporality

Brian Larkin (2013) begins his influential essay on infrastructure by observing that "infrastructures are built networks that facilitate the flow of goods, people, or ideas and allow for their exchange over space" (328). Space and spatiality naturally come to mind when thinking of infrastructure's features and effects. Infrastructures bridge distance; roads, railways, wires, and pipes help connect one point to another, and they are heavily dependent on and constitutive of local geographic contexts (Hughes 1983; Coutard et al. 2004).

Whether one thinks of channels of transport like railway lines or flight paths, of electric and communication wires, or the movement of resources like water or oil in pipelines, it is the connection through space that is central to the working of infrastructure. As Larkin observes, "For some time now, scholars in science and technology studies and geography have analyzed how infrastructures mediate exchange over distance, bringing different people, objects, and spaces into interaction and forming the base on which to operate modern economic and social systems" (2013: 330). But infrastructure, of course, mediates time as much as it mediates space (Degani 2013; Hetherington 2014). Infrastructures configure time, enable certain kinds of social time while disabling others, and make some temporalities possible while foreclosing alternatives (Barak 2013).

Revisiting two ideas that have become commonplace in the present—time-space compression and just-in-time production—demonstrates the imbrication of time with infrastructure with particular clarity. First, the notion of space-time compression, popularized by David Harvey in *The Condition of Postmodernity* (1989), referred in part to the ability to conduct "real-time" financial transactions across the globe. Second, just-in-time production referred to supply-chain changes enabled by global shipping, containerization, and the global factory floor, all of which sharply cut the capital tied up in products sitting in warehouses by more closely aligning supply with demand, thus significantly reducing the chances of a crisis of realization (D. Harvey 1989). What were the infrastructural conditions that facilitated the move toward real-time transactions? Much of this story hinges on an effort to lay undersea fiber-optic cables that connected global financial centers. As Nicole Starosielski's (2015) work demonstrates, this messy project is deeply entangled with daily life in Guam, undersea aquatic life, and both colonial and cold war telegraph and telephone infrastructures. Just-in-time production too depended on the installation of communications infrastructure, as well as new technologies for inventory control and management, not to mention containerization and global shipping (Carse 2014). These infrastructures of contemporary capitalism were developed over long periods of time, in a process that was neither linearly progressive nor uniform (Rosenberg 1976; Elster 1983). Thus, time-space compression is itself a temporal process that comes into being with the simultaneous development of new technologies of communication (fax machines, fiber-optic cables), a massive investment of capital and labor to connect vast distances with these technologies, and new methods of managing inventories and logistics (Sassen 1991; Starosielski 2015). Once installed, these infrastructures introduced new (and always more fitful than portrayed) temporalities in the

worlds of finance, commodities, and labor, which in turn changed the nature and experience of social time and social space.

In *Knowing Capitalism* (2005), Nigel Thrift writes that "it is all too easy to depict capitalism as a kind of big dipper, all thrills and spills. But capitalism can be performative only because of the many means of producing stable repetition which are now available to it and constitute its routine base" (3; see also Gupta 1992). Infrastructure, of course, is chief among these means of producing the more or less stable performance of both real-time transactions and just-in-time production. While Thrift does not use the term infrastructure specifically, he seems to be urging our attention to it—toward what he calls "the apparatus of installation, maintenance, and repair" on the one hand, and "the apparatus of order and delivery" on the other." Thrift writes, "For some reason, perhaps to do with their extreme everydayness, these apparatuses are constantly ignored in the literature, and yet it could be argued that they constitute the bedrock of modern capitalism" (2005: 3).

Thinking of time-space compression and just-in-time production through infrastructure paradoxically draws attention to the slowness of the process of speeding up. For example, it draws our attention to the resistance present in telegraph or fiber-optic cables—the difficulties involved in financing them, and then in installing and repairing them (Barak 2009; Starosielski 2015). Rigorous attention to infrastructure itself actually slows time-space compression enough to see delay, accretion, suspension, repair, resistance, and repurposing. Ethnographic attention to infrastructure may "ultimately undermine any idea that speed or time economy—the grossest simplification of efficiency's logics—is at the heart of capitalism. Instead, we will be able to explore the heterogeneous forms of pacing, duration, waiting, pause, obsolescence, and delay that also characterize its generative rhythms" (Bear et al. 2015: sec. 8; see also Bear 2015).

The larger point here is not to displace thinking about space by the logic of time, nor to privilege time over space. Focusing on time and temporality, in fact, helps us think of spatiality in new and interesting ways; it allows for a rethinking of spatialization as itself a temporal act and activity (Althusser 1969; D. Harvey 2005; Gidwani 2008). Temporality is built into spatial expansion, contraction, and scaling. Attention to the life span of infrastructure itself slows us in this way, hence attuning us to the shifting social temporalities that infrastructure produces. For example, a new metro system is rarely put into place all at once (Latour 1996). Instead, one main line is first prepared and started, which changes the time that it takes for people to commute from their homes to workplaces, or from one part of the city to another. It also changes the urban form, as new housing, offices, and shops spring up along the metro line. Real

estate markets shift as valuations of property that might have formerly been thought undesirable go up because they now are adjacent to the metro line. Then, as new lines are added to the metro, further shifts take place in commute times and in the urban form. The temporality of infrastructure, therefore, matters a great deal in the creation of spatial patterns of living, working, and entertainment; it influences the direction and degree of spatial extension; and it has profound social and political impacts. Like metros and rail lines, highways, cable networks, and even wireless communication all extend spatially over time, and it is this temporality that in turn produces variegated forms of spatiality and particular patterns of sociality.

A perfect example of the temporal interplay between spatial and social extension is provided by Antina von Schnitzler's work on metered water and electricity in South Africa. In response to the supply of expensive water and electricity in the townships of South Africa, residents found a way to tamper with the meter so that they did not have to pay high bills. In response, utilities began providing connections through a new tamper-proof technology of prepaid meters. In this case, the spatial extension of piped water and electricity encountered political resistance, but precisely because the spatial extension unfolded over time, that resistance was itself enfolded in a new technology of governmentality. The spatial, the temporal, and the political were mutually produced in this encounter. Or consider Nikhil Anand's work on water politics in Mumbai: the spatial extension of pipes that can potentially supply nonauthorized settlements with municipal water depends on a politico-temporal trajectory, one in which elaborate negotiations occur over an extended period of time among slum residents, politicians, and engineers and managers in the hydraulic bureaucracy. The outcome of such negotiations is always uncertain and subject to revision. Thus, the relationship between having pipes and having water is always up for grabs, and it can swing one way or the other depending on the social and political climate.

Once we conceptualize infrastructures not just in terms of the different places that they connect, but as spatiotemporal projects—as chronotopes—then we can open up new ways of thinking about the temporality and spatiality of infrastructure. As opposed to the "finished" product of a planner's map, if we think of infrastructures as unfolding over many different moments with uneven temporalities, we get a picture in which the social and political are as important as the technical and logistical (Gupta, this volume). Another way to say this is that conceptualizing infrastructure as a process over time ensures that the technical and logistical sides of infrastructure are not privileged over, or seen as separate from, its social and political, or formal and aesthetic sides

(Larkin, this volume; Schwenkel, this volume). Paying attention to the temporality of infrastructure makes us aware that the same technical features can produce very different configurations of space and sociality than those designed by planners. Many projects do not work out as planned because, as they are implemented, social and political pressures force alterations in their design and in their function.

A processual view of infrastructure focuses on infrastructure's protean forms (Star and Ruhleder 1996; Graham 2010). Looking both across and even within the different phases of infrastructure's life span—design, financing, construction, completion, maintenance, repair, breakdown, obsolescence, ruin—one can see the operation of multiple temporalities and trajectories. For example, as Gupta's essay in this volume points out, once an infrastructure project is started, it does not necessarily have to be completed. It can be suspended or abandoned, delayed or deferred. Abandonment and suspension can result from social and political struggles regarding the project, or they can be an outcome of technical, political, and financial failures.

Even after a project is completed, it is always changing. These changes are due to the materiality of the infrastructure itself. Decay and deterioration affect all materials. For instance, pipes made of steel, copper, or PVC will have different rates and probabilities of failure over time. The life cycle of materials may create high or low probabilities of breakdowns and ruptures. And yet, however important materials may be for explaining failures, referring to the qualities of materials in isolation is insufficient. Time and infrastructural life spans are made relevant through historical relations with others.

We also have to take into account gaps in knowledge or a lack of resources for routine maintenance. More importantly, the social and political life of infrastructure changes over time. With the rise of air travel, railway stations decline in importance. Similarly, gas stations may become less ubiquitous with the move to electric cars. Highways and metro lines often split existing communities or are used in processes of gentrification to displace certain residents and welcome others (Winner 1999; Graham and Marvin 2001). And what happens when highways or train lines are discontinued? When infrastructures seem to disappear? In an essay originally prepared for the project from which this volume emerged, Catherine Fennell asks what new kinds of sociality and obligation come into being when infrastructure is abandoned (Fennell n.d.)? Her essay on house demolition in the United States' late industrial Midwest underlines the point that abandonment is not a moment but a process. As urban housing stock is razed, political controversies and public health concerns rise alongside dusts released through the destruction of cities considered

"overbuilt" in the wake of deindustrialization. How is the construction and reproduction of social time altered as a result? A focus on the temporal helps us think of the spatial, technical, material, logistical, political, and social properties of infrastructure together.

Focusing on temporality, however, is important for another reason that has to do with what Larkin (2013) has called the poetics of infrastructure. Infrastructures are important not just for what they do in the here and now, but for what they signify about the future. Particular infrastructures signal the desires, hopes, and aspirations of a society, or of its leaders. Nation-states often build infrastructures not to meet felt needs, but because those infrastructures signify that the nation-state is advanced and modern (Ferguson 1999; Apter 2005; Appel 2012b; Harvey and Knox 2015; Gupta, this volume). That is why there is always greater investment in future-oriented infrastructures than is justified by their expense. Shiny new airports with huge capacities are built in many countries although they only serve a tiny elite, whereas less glamorous infrastructures, which would actually be more useful to the poorer segments of the population, are ignored or overlooked. This aspiration toward a modern future is often widely shared by large segments of the population. Focusing on these investments makes evident a hitherto hidden temporality. Different visions of the future, different aspirations for one's own life, and for the future of the community or nation, play an important role in shaping which infrastructure projects find support among populations. Like the building of infrastructure itself, emotional and affective investments, too, are not forged once and for all, but take time to be formed, and can change from positive to negative over a period of time. In other words, the affective relationship between people and infrastructure, while being shaped by notions of futurity, is not always positive and may instead result in deferral, ruination, suspension, abandonment, and repurposing (Stoler 2013).

Finally, there is another way in which the temporality of infrastructure proves to be important. Infrastructures often exceed human lifetimes (Bowker 2015). Bridges, roads, and buildings live longer than most humans and promise to continue to matter after our death. Even in a relatively young nation-state such as the United States, the oldest, continuously used bridge dates to the late seventeenth century. The effects of infrastructures dependent on fossil fuels—from coal-fired power plants to superhighways, flaring oil and gas wells to airline travel—will persist in the atmosphere for many generations. Nuclear wastes will probably pollute the earth long after humans are extinct. Global oil infrastructure offers a good illustration of the long lifetime of infrastructure, both in its own tenaciously obdurate life span and in its afterlives. A sketch of

this massive infrastructural network would include 5 million producing wells across the world (3,300 of which are subsea); more than 2 million kilometers of surface pipelines and another 75,000 kilometers running along the seafloor; 6,000 fixed oil platforms and 635 offshore drilling rigs; and more than 4,000 oil tankers moving 2.42 billion tons of oil and oil products every year (Bridge and Le Billon 2013; Appel, Mason, and Watts 2015). This is a radically work-intensive and dynamic infrastructural network, constantly under repair, maintenance, expansion, and contraction as certain resources are exhausted and others are accessed, as geopolitics change, and as cost-effectiveness and political viability of various extractive technologies evolve. The network is also unevenly defined not only by exploration, extraction, transport, and delivery, but also by leakage, breakage, and sabotage. The Anthropocene, intimately bound to fossil fuels, focuses our attention on the temporalities of this network—not only the grave inertia in the face of needed retrofit or conversion to other fuel sources, but also, of course, the atmospheric afterlives of all its combusted products that will long outlive the wells, pipelines, and tankers themselves. Thinking of the temporality of infrastructure draws us into another way of thinking beyond the human that has to do with other timescales, times that are not scaled (down) to human life, and only draw meaning from those lives. To decenter humans is in part to think about other time spans, the lifetimes of other things that shape life on the planet, and infrastructure is one important element in such a rethinking.

It is perhaps a sign of infrastructure's capaciousness, however, that we can use it to think across radically different scales—from planetary epochs to the most intimate acts of individuals, families, and communities. It is to these questions of intimacy—what Fennell has described as infrastructure "pressing into the flesh"—that we now turn to look at how infrastructure allows us to reframe politics.

Infra Politics: Intimacy, Publics, Matter

Politics

Infrastructures are a critical site through which politics is translated from a rationality to a practice, in all its social, material, and political complexity (Humphrey 2005). They are a material and aspirational terrain for negotiating the promises and ethics of political authority, and the making and unmaking of political subjects. Because infrastructures distribute vital resources people need to live—energy, water, information, food—they often become sites for

active negotiations between state agencies and the populations they unevenly govern. As such, several authors in this volume theorize how politics is enacted in everyday life by attending to the performances of infrastructure. To do this, they suggest we attend more closely to infrastructural forms, the ways in which their administrations gather publics and distribute life not just in terms of aspirations and possibilities, but, in their very material sense, to flourish and to proliferate life. After all, life not only has meaning, and is not just symbolic, but is also matter. Life's materiality, Didier Fassin reminds us,

> is not simply, in the Marxian sense, that of the structural conditions which effectively largely determine the conditions of life of the members of a given society; it is also, in Canguilhem's sense, that of the very substance of existence, its materiality its longevity and the inequalities that society imposes on it. To accept this materialistic orientation is not a merely theoretical issue. It is also an ethical one. It recognizes that the matter of life does matter. (2011: 193)

The #BlackLivesMatter movement and the Movement for Black Lives have argued along similar lines, where the infrastructural violence of Detroit and Flint sharpens claims to infrastructural justice and invest/divest platforms demand a "rebuilding and repair plan for domestic infrastructure across the country based on a commitment to a green economy and deep understanding of the threat of climate change" (https://policy.m4bl.org/invest-divest/). Fassin, in other words, is not alone in gesturing to the politics of distribution in recent years (see also Ferguson 2015). The Foucauldian scholar Thomas Lemke (2014) recently urged "relational materialism" for exploring the emergence of liberal modes of rule through material forms. To understand its processes, Lemke suggests, we need to articulate more carefully the link between the "matter of government and the government of matter" (2014: 14). To govern infrastructure, we argue, is to govern the politics of life, with all its inequalities.

Infrastructures are critical sites for the distribution of life and a key locus for the performance (and theorization) of politics and polities today. For instance, consider the ways in which water infrastructures are designed, installed, and managed in cities. To produce a hydraulic infrastructure does indeed require a population to be defined, delimited, and imagined through a planning process. Throughout this process, government officials, hydraulic engineers, and construction firms are called upon to design a system that can serve a given population. This population is itself discursively formed through practices of counting and measurement. Nevertheless, this population is only socially and materially brought into being with and through the everyday flow of water

through the pipes that (do or do not) ensue, a population that Anand (this volume) has termed "hydraulic publics." Alignments of the pipes, politics, laws, and policies materially gather, constitute, and manage the population of the city. As a governmental service, or a privatization controversy (as in Detroit, Delhi, or Mumbai), water pipes define not only who its subjects are, but also how they are collectively and differentially "treated" by the (public or private) institutions that administer infrastructures. Through everyday connections and disconnections, pipes, roads or electricity wires form populations that are unevenly governed and left aside.

This kind of attention to infrastructure unsettles long-accepted understandings of how rule is accomplished. If "liberalism is a form of government that disavows itself, seeking to organize populations and territories through technological domains that seem far removed from formal political institutions" (Larkin 2013: 328), ethnographic attention to infrastructure—from public toilets to municipal water systems, from roads to leaded homes—forces us to rethink governance and citizenship not at a distance but pressing into the flesh, through questions of intimacy and proximity. Taken together, the authors in this volume describe not only how infrastructures interpellate specific types of subjects, but how the immediacy and intimacy of infrastructures enable those subjects to "hail the state" and recognize them as publics (Anand, this volume). Infrastructure does not allow state power to disavow itself. On the contrary, it is an intimate form of contact, presence, and potential, one that serves as an important locus for the evaluation of the morality and ethics of political leaders and the state.

Indeed, the very idea of "disruption" operates with the assumption that quietly working infrastructures are "normal." A "disruption" such as a strike or work slowdown, draws attention to all the labor that goes into making infrastructures work invisibly and quietly behind the scenes. Thus, while infrastructures may be planned or designed with certain populations in mind, Christina Schwenkel demonstrates how these are frequently repurposed by others through political claims and material practices. We are arguing neither that the socialities and polities of populations are effects of infrastructural forms, nor that infrastructural forms just result from human social and political relationships and technologies (see Larkin, this volume). Instead, as infrastructures such as roads, communications infrastructures, or energy grids are built over more-than-human lifetimes (Braun 2005; Bowker 2015), populations and publics are constituted iteratively—with and through the materials of infrastructure, not just prior to or following its construction (Braun and Whatmore 2011).

Publics, therefore, are not only formed and controlled through an extension of infrastructures. By tugging, pulling, and demanding infrastructures to recognize, serve, and subjectify them, publics also make themselves visible as demanding subjects of state care. This is true, of course, not only of public or service delivery infrastructures, but of private infrastructures as well. To the extent that infrastructures of production, transport, delivery, and marketization enable the daily performances of capitalism, they are also central to potential disruptions (Mitchell 2011). Strikes, roadblocks, port shutdowns, work slowdowns, and sabotage all hinge on access to infrastructure in order to disrupt the exchange of goods, people, resources, and ideas over space (von Schnitzler 2016).

Like the building of a road, the constitution of populations is a project: a work-intensive endeavor that is often sporadic and stuttering. Infrastructures do not just help us to rethink politics, offering new ground on which to watch how publics take shape and disperse. They also help us think through the classical literature on publics (Habermas 1989; Warner 2002) to show how publics are not just made through enunciatory communities, circulations of intention, text, and speech that produce disembodied spheres of deliberation and fantasies of free circulation. The authors in this volume show how publics are also made by infrastructures that assemble collectives, constitute political subjects, and generate social aspirations. Different chapters in this volume suggest how publics are both brought into being and forestalled through infrastructural processes, such as the construction of a highway (Harvey, this volume), shared defense of bridges and power plants in bombarded cities (Schwenkel, this volume), the politics of municipal service delivery (von Schnitzler, this volume), or the mass destruction of urban housing stock in the U.S. Midwest (Fennell n.d.).

Of course, there is no predictable relation between infrastructures and the production of publics. As von Schnitzler (this volume) points out, water meters in South Africa have the capacity both to constitute publics and to truncate or fracture them. In other words, the fact that infrastructures can participate in the making of publics does not mean that they always do so. On the contrary, the vitality of their material form is overdetermined, and infrastructures can just as easily impede and proscribe the formation of publics (Rodgers and O'Neill 2012; Harvey and Knox 2015). Appel (2012b) shows that a surfeit of private infrastructure investment by U.S. oil firms in Equatorial Guinea, reminiscent of colonial infrastructures, works to provision markets and expatriates while deliberately excluding Equatoguineans, so that the oil companies are not held responsible for Equatoguineans or liable for any harm done to the

population. Outside the walls of U.S. oil enclaves, Equatoguinean state representatives routinely attribute a deferral of "the public"—the tenacious problems of electricity distribution, a potable water supply, healthcare and education provisioning, not to mention the draconian limits on press and political organizing—to the need to focus first on infrastructure. Here, materialized infrastructures are both "objects of the future and justifications of the present's constant deferral" (Appel, this volume).

Matter

That publics can be gathered or forestalled by the materials of infrastructure, often despite the political imaginaries or social aspirations embedded in their design, complicates any neat relation between matter, human-centered accounts of politics, and infrastructural form. In recent years, new materialist scholarship, drawing on more established research in the STS field, has urged that nonhumans be included as actors in the theorization of politics (Latour 1996; Bennett 2010). For the new materialists here, nonhumans could include other life forms—like scallops (Callon 1984); jaguars (Kohn 2013); mountains, or other types of matter perceived to be inanimate in Christian cosmologies (de la Cadena 2010); or mechanical coupling systems (Latour 1996). Nonhumans, vital materialists remind us, are "vibrant" and have both an existence and a "force" that is "beyond the human" (Bennett 2011; Kohn 2013; Meehan 2014). Such scholars urge us to attribute some form of political agency to different kinds of actors in an infrastructural assemblage. Yet, as Arjun Appadurai (2015) has pointed out, new materialist scholarship continues to lack a sufficient accounting of history, difference, and responsibility (O'Neill and Rodgers 2012). As Appadurai asks provocatively,

> If agency in all its forms is democratically distributed to all sorts of dividuals, some of which may temporarily be assembled as humans and others as machines, animals, or other quasi agents, then do we need to permanently bracket all forms of intrahuman judgment, accountability, and ethical discourse? Will future courts only be judges of assemblages of hands-guns-bodies-bullets and blood or of syringes-heroin-junkies-dealers or of ricin-envelopes-mailboxes-couriers and the like? And, worse, who will be the judges, witnesses, juries, prosecutors, and defenders? Will our very ideas of crime and punishment disappear into a bewildering landscape of actants, assemblages, and machines? If the only sociology left is the sociology of association, then will the only guilt left be guilt by association? (2015: 24)

Several essays in this volume have engaged these contemporary debates, as we try to widen the field of political action while staying carefully tuned to our ethnographic research that reveals historical and social accretions of difference, marginality, and responsibility between human actors. Together, we demonstrate how matter and nonhuman relations are not just an inert substrate that yields to the dreams and desires of powerful (human) actors. Instead, infrastructure's materials are active participants in its form and, therefore, also its politics. For instance, in this volume Dominic Boyer argues, via a careful reading of Marx, that we might think of infrastructure's materials as "a potential energy-storage system, as a means for gathering and holding productive powers [of capital, but also of state] in technological suspension." As a congealed and transformed process of people and things, infrastructure is generative and transcendent. Yet, its effects are themselves heavily contingent on the mediations of its materials. A misalignment of these material forms can, as we noted in the case of the Deepwater Horizon spill, "blow the very same [tenuous] arrangement 'sky-high' " (Boyer, this volume).

Nevertheless, at the same time, we do not attribute to the materials of infrastructure either a primacy or an independent existence that is discrete and beyond (human) history (Larkin, this volume). Thus, Penny Harvey (2015) points out that "the point of interest is not simply that materials always carry their own vitality (Ingold 2012) or exert a degree of autonomous force or agency (Bennett 2010), but rather that this force is never generic, nor is it simply material." Concrete, steel, copper, and the other materials of infrastructure are historical forms that emerge through and with social systems of ideology, meaning, and imagination. They are simultaneously technical and aesthetic devices that are brought into being by relations between imagination, ideology, and technicity that have a history, a present, and a future, constantly "producing new experiences of the world" (Larkin 2015). In this volume, we refuse to accord primacy either to the powers of human representation to account for material forms, or to the powers of materials in their imagined, ahistorical, elemental state to determine infrastructural forms. Instead, as things become political only through relations (Barry 2001), we call for a recognition that materials and ideology together participate in the makings of infrastructure, politics, and publics. These relations are uneasy and difficult to anticipate in advance but can be revealed through careful historical and ethnographic research.

If material is always caught up in meaning, an attention to the materiality of infrastructure reveals how it is central to the sensory, somatic, and affective ways in which we inhabit this world (Mrázek 2002; Larkin 2013). On one hand, we notice, and make meaning of, infrastructure through a variety of senses. As

Schwenkel argues, "Infrastructure, broken or not, often evokes a multiplicity of embodied sensations across the human sensorium" (2015b). Infrastructures excite affects and sentiment, whether it is people hearing the roar of a highway, or feeling the stillness of time and air on their skin during an electricity blackout, or seeing a particular kind of past in the abandoned chimneys of a socialist energy plant. Infrastructures produce a sense of belonging, accomplishment, or loss, as polities are constantly being unmade and remade through not only the things that infrastructures carry, but also the semiotic and sensory ways in which they shape being.

But infrastructures are not just sensed; they also "press into the flesh," materializing and "emplacing" new figurations of the body (Fennell n.d.). The mortgaged American home, Fennell underscores, is central to national projects of wealth expansion, economic mobility, and collective provisioning. Focusing on large-scale housing demolition in the late industrial, urban U.S. Midwest, Fennell highlights the "noxious aspects" of political emplacement. She tracks how those tasked with removing vacant houses grapple with the potential health effects of abandoned, decaying, but also demolished, infrastructures. Here the process of a retreating infrastructure does not just entail the disconnection of political subjects. The abandonment and demolition of the house are also experienced as a toxic uncertainty, one whose materials might become absorbed by a body and continue to inhabit it, long after the promise of infrastructures—and the dreams of access and recognition that constitute them—has been carted away as rubble.

Conclusion: On Promise

As Susan Leigh Star has noted, "One person's infrastructure is another's topic, or difficulty" (1999: 380). "Modern" infrastructure may be as various as a contractual obligation between transnational oil corporations and states (Mitchell 2011; Appel 2012b), or a set of high-speed fiber-optic cables that, viewed from one perspective, allow twenty-four-hour workdays, but, from another, disrupt the sleep and kinship patterns of call-center workers in Bangalore (Aneesh 2006; Starosielski 2015). Whether they are being built or crumbling, infrastructures simultaneously index the achievements and limits, expectations and failures, of modernity. We inhabit worlds already formed by differentiated infrastructures, making them good to think with in the classic ethnographic sense. In this volume, we see how the material and political lives of infrastructure frequently undermine narratives of technological or social progress, drawing attention instead to the shifting terrain of modernity, distribution, inclusion, and

exclusion in most of the world. As materials and technologies transform, so do their promises. New infrastructures are promises made in the present about our future. Insofar as they are so often incomplete—of materials not yet fully moving to deliver their potential—they appear as ruins of a promise. Infrastructures in Equatorial Guinea, Bangalore, or Detroit do not only promise a future. Suspended in the present, they symbolize the ruins of an anticipated future, and the debris of an anticipated or experienced liberal modernity. In the final section of this introduction, and in the chapters that close the volume, we engage more explicitly with the promise of infrastructure.

At its most basic, the promise of this volume is that ethnographic attention to infrastructure offers new empirical terrain on which to understand the entanglements of social, political, economic, biological, material, aesthetic, and precarious, threatened life. Attention to the lives of infrastructures helps us think about possible worlds and new relations between life, matter, and knowledge in the Anthropocene, or what Donna Haraway (2016) has usefully expanded to the Anthropocene, Capitolocene, and Chthulucene. Infrastructures are promising locations for ethnographic research precisely because they are sites of conceptual trouble that refuse the easy separation of the human and the material; they are more-than-human forms that demand acknowledgment of sociomateriality. Infrastructures are where aesthetics, meaning, and materiality meet (Fennell n.d.). They promise an assessment of social life that "sidesteps the limits of humanism without erasing the human, and . . . allows for a dynamic and open sense of scale that does not assume a singular perspective" (Harvey, this volume).

Each chapter in the volume thinks through the question of promise not only as the intellectual potential of the task at hand, but also as an embodied experience of infrastructure itself around the world. Opening the book's section devoted to time, Hannah Appel writes about the lived experience of spectacular rates of infrastructural investment and construction in Equatorial Guinea. Noting infrastructure's centrality to ideas of the national economy and economic growth, Appel argues that attention to infrastructure lays bare the promises and betrayals of developmental time, oil time, political time, and imperial time. Infrastructural time emerges as a new mode of attention to archaeologies of the present, affording multiscalar insights into today's imperial formations and the poisoned promise of economic growth.

Akhil Gupta continues these archaeologies of the present in chapter 2, with a focus on suspension and a rereading of ruins through half-built infrastructure projects in Bangalore. Rather than the elegiac decay of once-flourishing civilizations, Gupta terms the incomplete infrastructure projects "the ruins of

the future," wherein "ruination is not about the fall from past glory but this property of in-between-ness, between the hopes of modernity and progress embodied in the start of construction, and the suspension of those hopes in the half-built structure." If promise is "that which affords a ground of expectation of something to come," Penny Harvey attends to the longing many Peruvians articulate in relation to roads in chapter 3. In a moment when infrastructures seem to be the current currency of investment across much of the global South, she asks, what are the grounds of expectation that accompany infrastructural projects? Concluding the section on time, Christina Schwenkel shows how smokestacks in postcolonial Vietnam concretized the promise of technological prosperity, but were always already alloyed not only with risk and calamity, but also by political subjection. Resonant with Larkin's attention to infrastructure's political aesthetics in chapter 7, Schwenkel shows us in chapter 4 that under the banner "Đảng là ánh sáng" (the Party is the light), electrification projects brought new symbolic legitimacy to the postcolonial government at the same time as they justified novel forms of oppression and desperation.

Antina von Schnitzler's work opens the book's second section on infrapolitics. Through the unlikely ethnographic subject of the toilet, von Schnitzler argues in chapter 5 that infrastructure's epistemological promise is not given but contingent. She writes that, for her purposes, "infrastructure is both an ethnographic object and an epistemological vantage point from which to understand a less apparent postapartheid political terrain and a location from which the South African present may be defamiliarized and the political rethought." Indeed, the promise of the book's second section is that ethnographic attention to infrastructure yields new insights with which to theorize politics and political life. As Nikhil Anand shows in chapter 6, infrastructures (or their absence) may not only constitute and control populations, but they are also dream worlds of promise that are actively desired and called upon by marginalized groups. Attention to infrastructure allows us to show the making and management of difference—class, race, gender, religion, and beyond—in the technics and politics of everyday life.

Together, the chapters in the second section join the domestic home to the apparatus of the state, and less frequently to capital, showing infrastructures as sites of conceptual and scalar trouble. For this reason, they offer a creative location for the production of political theory. For example, infrastructures often quite literally connect and constitute boundaries between public and private, boundaries that people sometimes reject or attempt to transgress. Governance, it turns out, does not take place at a distance but through the intimacy and proximity of toilets, pipes, and potholed roads.

Brian Larkin begins the book's final section on the question of promise. Thinking through form and political aesthetics, Larkin argues in chapter 7 that infrastructures "address the people who use them, stimulating emotions of hope and pessimism, nostalgia and desire, frustration and anger, that constitute promise (and its failure) as an emotive and political force." Larkin uses the idea of promise to critique the suggestion that matter can be apprehended apart from or a priori to form. "The promise of infrastructure," he writes, "derives from exactly the political rationalities, sense of expectation, and desire that take us into the realm of discursive meaning. . . . The very word 'promise' implies that a technological system is the aftereffect of expectation; it cannot be theorized or understood outside of the political orders that predate it and bring it into existence." To think about infrastructures productively, Geoff Bowker insists in the chapter that follows, is also to acknowledge the problematic intellectual orders in which most of us have been trained. As Bowker argues in chapter 8, the Baconian classification of academic disciplines, produced in the eighteenth and nineteenth centuries, specifically sought to distinguish between the human and natural sciences and between technology and society. Produced in a historical moment where the sciences were being figured by Enlightenment thinkers, these divisions continue to constrain academic labor. They constrain and shape—enframe—the study of infrastructure, an inherently transdisciplinary (or de-disciplinary) phenomenon. If we are living in the ruins of Cartesian dualism, then we will need not only new material infrastructures, but also new epistemological infrastructures to confront the present moment. Bowker asks, "How do we reimagine the nature of knowledge for the way the world is now? How do we put into infrastructures forms of knowledge production that can bear the weight of these new exigencies?"

In the chapter that concludes the volume, Dominic Boyer is also concerned with the relationship between infrastructure and epistemic and political orders, and his question is about the revolutionary dissolution of our current order, and infrastructure's potential role therein. Boyer concludes by asking how infrastructures themselves shape what is possible to think about energy use and climate change (see also Jensen n.d.). The "impossibility" of a rapid shift to renewable energy is often articulated around sedimented infrastructures like pipelines or electrical grids. And yet, if infrastructures distribute power, they are also sites of vulnerability (Mitchell 2011). The same arrangements that produce their dominance can (and perhaps are) being blown sky-high with the climate crisis. As nation-states seek to proliferate renewable energy sources following the Paris climate accord, wind and solar infrastructures are generative of new forms of sociality and may revolutionize hierarchies and privileges

accreted in existing distribution regimes. Through a novel reading of Marx, Boyer encourages us to look at infrastructure as potential, radical energy; he asks how infrastructure can do or "promise" something other than to reenable the present anthropocentric trajectory. Drawing on Sara Ahmed's (2014) work, Boyer intertwines the call for revolutionary infrastructure with a call for a revolution in "transcendence-seeking 'hypersubjects' (usually but not exclusively white, straight, northern males) that gifted the world the Anthropocene as part of their centuries-long project of remaking the planet for their own convenience and luxury." He quotes Ahmed (2014) who wrote, "It takes conscious willed and willful effort not to reproduce an inheritance," and fittingly ends with a plea: please do what you can to help.

The concluding chapters on the theme of promise, then, show infrastructure as not just theoretically generative, but also essential to contemplate in the political and environmental conjuncture we are writing and thinking in. If infrastructures of energy and other resources have been key in enabling the sustaining of unsustainable rates of resource extraction, energy consumption, climate change, and planetary transformations that are now being called the Anthropocene, it is in their re-forming and re-making that we might imagine and produce different relations of distribution and circulation.

What kinds of infrastructure—epistemic, energetic, political—might we contemplate from the everyday ruins and rubble wrought by infrastructure today? How might we reimagine their forms and potentialities anew in times where the end of life itself has been rendered thinkable? In an era where federal commitment to knowledge production is weakening, and universities and institutions are struggling to maintain public funding, a politics of infrastructure necessarily asks after its potential to transform the world we currently inhabit.

Ethnographic work, we suggest, can help redeem the promise of infrastructure by making more visible, and indeed more political, the formative role of infrastructures in the ways we think, build, and inhabit our shared futures. And this may be most timely and necessary in the Anthropocene. As the promises of modernity are crumbling under neoliberal austerity and climate change, the ruins of liberalism are manifest in the sociomaterial remnants of oil wells and superhighways, water pipes and shipping channels, fiber-optic cable and an ever-growing pile of rubble. What kinds of futures and future polities will today's infrastructures leave behind? What are the dreams that may be re-gathered amid its rubble (Gordillo 2014; Jackson 2014)? When the infrastructures of history continue to reverberate in our figurations of the future, what kinds of structures and limits do they leave us with? As the infrastructures we live with are remade, they provide us with an opportunity to think, imagine, and rebuild the

world differently. Can we produce a world that can be distinguished from the constitutive divisions of modernity and its progressive readings of the future, given that the epistemic and concrete glue of infrastructure binds that future to our present and our past?

REFERENCES

Act 436 of 2012. Michigan Compiled Laws Complete § 141.1541–75, *The Michigan Legislature Website*. http://legislature.mi.gov/doc.aspx?mcl-Act-436-of-2012.

Ahmed, Sara. 2014. White Men. *feministkilljoys*, November 4, 2014. https://feministkilljoys.com/2014/11/04/white-men.

Althusser, Louis. 1969. *For Marx*. Translated by B. Brewster. New York: Pantheon Books.

Anand, Nikhil. 2011. Pressure: The PoliTechnics of water supply in Mumbai. *Cultural Anthropology* 26: 542–564.

———. 2017. *Hydraulic city: Water and the infrastructures of citizenship in Mumbai*. Durham: Duke University Press.

Anderson, Benedict R. 1983. *Imagined communities: Reflections on the origin and spread of nationalism*. London: Verso.

Aneesh, A. 2006. *Virtual migration: The programming of globalization*. Durham: Duke University Press.

Appadurai, Arjun. 2015. Mediants, materiality, normativity. *Public Culture* 27(2): 221–237.

Appel, Hannah. 2012a. Offshore work: Oil, modularity, and the how of capitalism in Equatorial Guinea. *American Ethnologist* 39: 692–709.

———. 2012b. Walls and white elephants: Oil extraction, responsibility, and infrastructural violence in Equatorial Guinea. *Ethnography* 13(4): 439–465.

Appel, Hannah, Arthur Mason and Michael Watts, eds. 2015. *Subterranean estates: Lifeworlds of oil and gas*. Ithaca, NY: Cornell University Press.

Apter, Andrew. 2005. *Pan African nation: Oil and the spectacle of culture in Nigeria*. Chicago: Chicago University Press.

Ballestero, Andrea. 2015. The ethics of a formula: Calculating a financial-humanitarian price for water. *American Ethnologist* 42(2): 262–278.

Barak, On. 2009. Scraping the surface: The techno-politics of modern streets in turn-of-twentieth-century Alexandria. *Mediterranean Historical Review* 24: 187–205.

———. 2013. *On time: Technology and temporality in modern Egypt*. Berkeley, CA: University of California Press.

Barnes, Jessica. 2014. *Cultivating the Nile: The everyday politics of water in Egypt*. Durham: Duke University Press.

Barry, Andrew. 2001. *Political machines*. London: Athlone.

———. 2013. Material politics: Disputes along the pipeline. Chichester, UK: Wiley-Blackwell.

Bear, Laura. 2015. *Navigating austerity: Currents of debt along a South Asian river*. Stanford, CA: Stanford University Press.

Bear, Laura, Karen Ho, Anna Tsing, and Sylvia Yanagisako. 2015. "Gens: A feminist manifesto for the study of capitalism." Theorizing the contemporary, *Cultural Anthropology* website, March 30, 2015. https://culanth.org/fieldsights/652-gens-a-feminist-manifesto-for-the-study-of-capitalism.

Behrent, M. C. 2013. Foucault and technology. *History and Technology* 29: 54–104.

Benjamin, Solly. 2005. Touts, pirates and ghosts. In *Bare acts*, Sarai Reader 05, 242–254. Williamsberg, NY: Autonomedia.

Bennett, Jane. 2010. *Vibrant matter: A political ecology of things*. Durham: Duke University Press.

Bowker, Geoffrey C. 1994. *Science on the run: Information management and industrial geophysics at Schlumberger, 1920–1940*. Cambridge, MA: MIT Press.

———. 2015. Temporality. Theorizing the contemporary, *Cultural Anthropology* website, September 24, 2015. https://culanth.org/fieldsights/723-temporality.

Boyer, Dominic. 2014. Energopower: An introduction. *Anthropological Quarterly* 87: 309–333.

Braun, Bruce. 2005. Environmental issues: Writing a more-than-human urban geography. *Progress in Human Geography* 29: 635–650.

Braun, Bruce, and Sarah Whatmore. 2011. *Political matter: Technoscience, democracy, and public life*. Minneapolis: University of Minnesota Press.

Bridge, Gavin and Philippe Le Billon. 2013. *Oil*. Cambridge: Polity Press.

Caldeira, Teresa Pires do Rio. 2000. *City of walls: Crime, segregation, and citizenship in São Paulo*. Berkeley, CA: University of California Press.

Callon, Michel, 1984. Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay. *The Sociological Review*, 32(1_suppl): 196–233.

Campbell, Jeremy. 2012. Between the material and the figural road: The incompleteness of colonial geographies in Amazonia. *Mobilities* 7: 481–500.

Carse, Ashley. 2014. *Beyond the big ditch: Politics, ecology, and infrastructure at the Panama Canal*. Cambridge, MA: MIT Press.

Certeau, Michel de. 2002. *The practice of everyday life*. Berkeley, CA: University of California Press.

Chakrabarty, Dipesh. 2000. *Provincializing Europe: Postcolonial thought and historical difference*. Princeton, NJ: Princeton University Press.

———. 2009. The climate of history: Four theses. *Critical Inquiry*, 35(2), 197–222.

Chatterjee, Partha. 2001. On civil and political society in post-colonial democracies. In *Civil society: History and possibilities*, ed. Sudipta. Kaviraj and Sunil. Khilnani, 165–178. New York: Cambridge University Press.

———. 2004. *The politics of the governed: Reflections on popular politics in most of the world*. New York: Columbia University Press.

Chu, Julie Y. 2014. When infrastructures attack: The workings of disrepair in China. *American Ethnologist* 41(2): 351–367.

Collier, Stephen. 2011. *Post-Soviet social: Neoliberalism, social modernity, biopolitics*. Princeton, NJ: Princeton University Press.

Coronil, Fernando. 1997. *The magical state: Nature, money, modernity in Venezuela*. Chicago: Chicago University Press.

Coutard, Olivier, Richard Hanley, and Rae Zimmerman, eds. 2004. *Sustaining urban networks: The social diffusion of large technical systems*. New York: Routledge.

Cramer, Jon and Rada Katsarova. 2015. Race, class, and social reproduction in the urban present: The case of the Detroit water and sewage system. *Viewpoint Magazine* (5). https://www.viewpointmag.com/2015/10/31/race-class-and-social-reproduction-in-the-urban-present-the-case-of-the-detroit-water-and-sewage-system.

De Boeck, Filip. 2011. Inhabiting ocular ground: Kinshasa's future in the light of Congo's spectral urban politics. *Cultural Anthropology* 26(2): 263–286.

———. 2015. "Divining" the city: Rhythm, amalgamation and knotting as forms of urbanity. *Social Dynamics: A Journal of African Studies* 41(1).

de la Cadena, Marisol. 2010. Indigenous cosmopolitics in the Andes: Conceptual reflections beyond "politics". *Cultural Anthropology* 25(2): 334–370.

Degani, Michael. 2013. Emergency power: Time, ethics and electricity in postsocialist Tanzania. In *Cultures of energy: Power, practices, technologies*, ed. S. Strauss, S. Rupp, and T. F. Love, 177–193. Walnut Creek, CA: Left Coast Press.

Edwards, Paul. 2003. Infrastructure and modernity: Force, time and social organization in the history of sociotechnical systems. In *Modernity and technology*, ed. T. Misa, P. Brey, and A. Feenberg, 185–225. Cambridge, MA: MIT Press.

Edwards, Paul, Geoffrey Bowker, Steven Jackson, and Robin Williams. 2009. Introduction: An agenda for infrastructure studies. *Journal of the Association for Information Systems* 10(5): 365–374.

Elster, Jon. 1983. *Explaining technical change: A case study in the philosophy of science*. Cambridge: Cambridge University Press.

Elyachar, Julia. 2010. Phatic labor, infrastructure, and the question of empowerment in Cairo. *American Ethnologist* 37: 452–464.

Engels, Frederick. (1884) 2010. The origin of the family, private property, and the state. Marxists Internet Archive. https://www.marxists.org/archive/marx/works/download/pdf/origin_family.pdf.

Escobar, Arturo. 1995. *Encountering development: The making and unmaking of the third world*. Princeton, NJ: Princeton University Press.

Fanon, Frantz. 1961. *The Wretched of the Earth.* New York: Grove.

Fassin, Didier. 2011. Coming back to life: An anthropological reassessment of biopolitics and governmentality. In *Governmentality: current issues and future challenges*, ed. U. Bröckling, S. Krasmann, and T. Lemke, 185–200. New York: Routledge.

Fennell, Catherine. n.d. Wasted house, leaded world. Unpublished manuscript, last modified November 11, 2016. Microsoft word file.

Ferguson, James. 1994. *The anti-politics machine: "Development," depoliticization, and bureaucratic power in Lesotho*. Minneapolis: University of Minnesota Press.

———. 1999. *Expectations of modernity: Myths and meanings of urban life on the Zambian Copperbelt*. Berkeley, CA: University of California Press.

———. 2012. Structures of responsibility. *Ethnography* 13: 558–562.

———. 2015. *Give a man a fish: Reflections on the new politics of distribution*. Durham: Duke University Press.
Furlong, Kathryn. 2014. STS beyond the "modern infrastructure ideal": Extending theory by engaging with infrastructure challenges in the South. *Technology in Society* 38: 139–147.
Geertz, Clifford. 1972. The wet and the dry: Traditional irrigation in Bali and Morocco. *Human Ecology* 1(1): 23–37.
Gidwani, Vinay. 2008. *Capital, interrupted: Agrarian development and the politics of work in India*. Minneapolis: University of Minnesota Press.
Gilmore, Ruth Wilson. 2007. *Golden gulag: Prisons, surplus, crisis, and opposition in globalizing California*. Berkeley, CA: University of California Press.
Gordillo, Gastón. 2014. *Rubble: The afterlife of destruction*. Durham: Duke University Press.
Graham, Stephen. 2002. Bulldozers and bombs: The latest Palestinian-Israeli conflict as asymmetric urbicide. *Antipode* 34: 642–649. https://doi.org/10.1111/1467–8330.00259.
———. 2010. When infrastructures fail. In *Disrupted cities: When infrastructure fails*, ed. Stephen Graham, 1–26. New York: Routledge.
Graham, Stephen, and Simon Marvin. 2001. *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. New York: Routledge.
Graham, Stephen, and Colin McFarlane. 2015. *Infrastructural lives: Urban infrastructure in context*. New York: Routledge.
Graham, Stephen, and Nigel Thrift. 2007. Out of order: Understanding repair and maintenance. *Theory, Culture and Society* 24: 1–25.
Gupta, Akhil. 1992. The reincarnation of souls and the rebirth of commodities: Representations of time in "East" and "West". *Cultural Critique* 22: 187–211.
———. 1998. *Postcolonial developments: Agriculture in the making of modern India*. Durham: Duke University Press.
———. 2012. *Red tape: Bureaucracy, structural violence, and poverty in India*. Durham: Duke University Press.
Gupta, Akhil, and James Ferguson. 1992. Beyond "culture": Space, identity, and the politics of difference. *Cultural Anthropology* 7(1): 6–23.
Habermas, Jürgen. 1989. *The structural transformation of the public sphere: An inquiry into a category of bourgeois society*. Cambridge, MA: MIT Press.
Haraway, Donna J. 1991. *Simians, cyborgs, and women: The reinvention of nature*. New York: Routledge.
———. 2003. *The companion species manifesto: Dogs, people, and significant otherness*. Chicago: Prickly Paradigm.
———. 2016. *Staying with the trouble: Making kin in the Chthulucene*. Durham: Duke University Press.
Harris, Marvin. 1966. The cultural ecology of India's sacred cattle. *Current Anthropology* 7(1): 51–56.
Harrison, Virginia. 2013. World's best economies in 2013. *CNN Online*. http://money.cnn.com/gallery/news/economy/2013/12/27/best-economies/2.html.

Harvey, David. 1989. *The condition of postmodernity: An enquiry into the origins of cultural change*. Oxford: Blackwell.
———. 2005. *A brief history of neoliberalism*. New York: Oxford University Press.
Harvey, Penelope. 2010. Cementing relations: The materiality of roads and public spaces pn provincial Peru. *Social Analysis* 54: 28–46.
———. 2015. Materials. Theorizing the contemporary, *Cultural Anthropology* website, September 24, 2015. https://culanth.org/fieldsights/719-materials.
Harvey, Penelope, and Hannah Knox. 2015. *Roads: An anthropology of infrastructure and expertise*. Ithaca, NY: Cornell University Press.
Hetherington, Kregg. 2014. Waiting for the surveyor: Development promises and the temporality of infrastructure. *Journal of Latin American and Caribbean Anthropology* 19: 195–211.
Highsmith, Andrew R. 2015. *Demolition means progress: Flint, Michigan and the fate of the American metropolis*. Chicago: University of Chicago Press.
Hughes, Thomas Parke. 1983. *Networks of power: Electrification in Western society, 1880–1930*. Baltimore, MD: Johns Hopkins University Press.
Humphrey, Caroline. 2005. Ideology in infrastructure: Architecture and Soviet imagination. *Journal of the Royal Anthropological Institute* 11: 39–58.
Inda, Jonathan Xavier. 2005. *Anthropologies of modernity: Foucault, governmentality, and life politics*. Malden, MA: Blackwell.
Ingold, Tim. 2012. Toward an ecology of materials. *Annual Review of Anthropology* 41: 427–442.
Jackson, Steven. 2014. Rethinking repair. In *Media technologies: Essays on communication, materiality and society*, ed. T. Gillespie, P. Boczkowski, and K. Foot, 221–239. Cambridge, MA: MIT Press.
Jensen, Casper Bruun. 2017. Pipe dreams: Sewage infrastructure and activity trails in Phnom Penh. *Ethnos* 82(4): 1–21.
———. n.d. Mekong scales: Domains, test-sites and the micro-uncommons. Unpublished paper. https://www.academia.edu/11623322/Mekong_Scales_Domains_Test-Sites_and_the_Micro-Uncommons.
Joyce, Patrick. 2003. *The rule of freedom: Liberalism and the modern city*. London: Verso.
Kale, Sunila S. 2014. *Electrifying India: Regional political economies of development*. Stanford, CA: Stanford University Press.
Kaviraj, Sudipta. 2001. In search of civil society. In *In search of civil society*, ed. Sudipta Kaviraj and Sunil Khilnani, 287–323. New York: Cambridge University Press.
Kohn, Eduardo. 2013. *How forests think: Toward an anthropology beyond the human*. Berkeley, CA: University of California Press.
Kothari, Ashish, and Rajiv Bhartari. 1984. Narmada Valley project: Development or destruction. *Economic and Political Weekly* 19(23): 907–920.
Lansing, John Stephen. 1991. *Priests and programmers: Technologies of power in the engineered landscape of Bali*. Princeton, NJ: Princeton University Press.
Larkin, Brian. 2008. *Signal and noise: Media, infrastructure, and urban culture in Nigeria*. Durham: Duke University Press.

———. 2013. The politics and poetics of infrastructure. *Annual Review of Anthropology* 42:327–343.
———. 2015. Form. Theorizing the contemporary, *Cultural Anthropology* website, September 24, 2015. https://culanth.org/fieldsights/718-form.
Latour, Bruno. 1996. *Aramis, or the love of technology*. Cambridge, MA: Harvard University Press.
———. 2012. *We have never been modern*. Cambridge, MA: Harvard University Press.
Law, John. 1987. *The social construction of technological systems: New directions in the sociology and history of technology*, ed. W. Bijker, T. P. Hughes, and T. Pinch. Cambridge, MA: MIT Press.
Lefebvre, Henri. 1991. *The production of space*. Cambridge, MA: Blackwell.
Lemke, Thomas. 2014. New materialisms: Foucault and the "government of things." *Theory, Culture and Society*. 32(4): 3–25.
Limbert, Mandana E. 2010. *In the time of oil : Piety, memory, and social life in an Omani town*. Stanford, CA: Stanford University Press.
Marcus, George E., and Michael M. J. Fischer. 1986. *Anthropology as cultural critique: An experimental moment in the human sciences*. Chicago: University of Chicago Press.
Mauss, Marcel. 2008. "Seasonal Variations of the Eskimo". In *Environmental anthropology: A historical reader*, ed. Michael R. Dove and Carol Carpenter, 157–167. Malden, MA: Blackwell.
Marres, Noortje. 2012. *Material participation: Technology, the environment and everyday publics*. Houndmills, UK: Palgrave Macmillan.
Maurer, Bill. 2012. Payment: Forms and functions of value transfer in contemporary society. *Cambridge Anthropology* 30(2): 15–35.
McFarlane, C., and J. Rutherford. 2008. Political infrastructures: Governing and experiencing the fabric of the city. *International Journal of Urban and Regional Research* 32: 363–374.
McKittrick, Katherine. 2011. On plantations, prisons, and a black sense of place. *Social & Cultural Geography* 12(8): 947–963.
Meehan, Katie. 2014. Tool-power: Water infrastructure as wellsprings of state power. *Geoforum* 57: 215–224.
Mehta, Lyla. 2005. *The politics and poetics of water: Naturalising scarcity in western India*. New Delhi: Orient Longman.
Melamed, Jodi. 2006. The spirit of neoliberalism: From racial liberalism to neoliberal multiculturalism. *Social Text* 24(4(89)): 1–24. https://doi.org/10.1215/01642472–2006–009.
Mills, Charles Wright. 2011. Liberalism and the racial state. In *State of white supremacy: Racism, governance, and the United States*, ed. Moon-Kie Jung, João H. Costa Vargas, and Eduardo Bonilla-Silva. Stanford, CA: Stanford University Press.
Mitchell, Timothy. 2002. *Rule of experts: Egypt, techno-politics, modernity*. Berkeley, CA: University of California Press.
———. 2011. *Carbon democracy: Political power in the age of oil*. London: Verso.
Mol, Annemarie. 2002. *The body multiple : Ontology in medical practice, science and cultural theory*. Durham: Duke University Press.

Morgan, Lewis Henry. (1877) 2004. *Ancient society, or researches in the lines of human progress from savagery through barbarism to civilization*. Marxists Internet Archive. http://www.marxists.org/reference/archive/morgan-lewis/ancient-society.

Mrázek, Rudolf. 2002. *Engineers of happy land: Technology and nationalism in a colony*. Princeton, NJ: Princeton University Press.

Nugent, David. 2004. Governing states. In *A companion to the anthropology of politics*, ed. David Nugent and Joan Vincent, 198–215. Malden, MA: Blackwell.

Ranganathan, Malini. 2016. Thinking with Flint: Racial liberalism and the roots of an American water tragedy. *Capitalism Nature Socialism* 27(3): 17–33. https://doi.org/10.1080/10455752.2016.1206583.

Redfield, Peter. 2005. Foucault in the tropics: Displacing the panopticon. In *Anthropologies of modernity: Foucault, governmentality, and life politics*, ed. Jonathan Xavier Inda, 50–79. Malden, MA: Blackwell.

Ribeiro, Gustavo Lins. 1994. *Transnational capitalism and hydropolitics in Argentina: The Yacyretá high dam*. Gainesville: University Press of Florida.

Rodgers, Dennis, and Bruce O'Neill. 2012. Infrastructural violence: Introduction to the special issue. *Ethnography* 13: 401–412.

Rosenberg, Nathan. 1976. *Perspectives on technology*. Cambridge: Cambridge University Press.

Rostow, W. W. 1960. *The stages of economic growth, a non-Communist manifesto*. Cambridge: Cambridge University Press.

Sassen, Saskia. 1991. *The global city: New York, London, Tokyo*. Princeton, NJ: Princeton University Press.

Schwenkel, Christina. 2013. Post/socialist affect: Ruination and reconstruction of the nation in urban Vietnam. *Cultural Anthropology* 28: 252–277.

———. 2015a. Spectacular infrastructure and its breakdown in socialist Vietnam. *American Ethnologist* 42(3): 520–534.

———. 2015b. Sense. Theorizing the contemporary, *Cultural Anthropology* website, September 24, 2015. https://culanth.org/fieldsights/721-sense.

Scott, James. 1998. *Seeing like a state: How certain schemes to improve the human condition have failed*. New Haven, CT: Yale University Press.

Sharma, Aradhana. 2008. *Logics of empowerment : Development, gender, and governance in neoliberal India*. Minneapolis: University of Minnesota Press.

Sheth, Falguni. 2009. Toward a political philosophy of race. New York: SUNY Press.

Simone, AbdouMaliq. 2004. People as infrastructure: Intersecting fragments in Johannesburg. *Public Culture* 16(3): 407–429.

———. 2012. Infrastructure: Introductory commentary. Curated collections, *Cultural Anthropology* website, November 26, 2012. https://culanth.org/curated_collections/11-infrastructure/discussions/12-infrastructure-introductory-commentary-by-abdoumaliq-simone.

Star, Susan Leigh. 1999. The ethnography of infrastructure. *American Behavioral Scientist* 43: 377–391.

Star, Susan Leigh, and Karen Ruhleder. 1996. Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information systems research* 7(1): 111–134.

Starosielski, Nicole. 2015. *The undersea network*. Durham: Duke University Press.
Steward, Julian. 1955. *Theory of culture change: The methodology of multilinear evolution*. Urbana: University of Illinois Press.
Stoler, Ann Laura. 2013. *Imperial debris: On ruins and ruination*. Durham: Duke University Press.
Sundaram, Ravi. 2010. *Pirate modernity: Delhi's media urbanism*. New York: Routledge.
Thrift, Nigel. 2005. *Knowing capitalism*. London: Sage.
Tsing, Anna. 2005. *Friction: An ethnography of global connection*. Princeton, NJ: Princeton University Press.
von Schnitzler, Antina. 2013. Traveling technologies: Infrastructure, ethical regimes, and the materiality of politics in South Africa. *Cultural Anthropology* 28: 670–693.
———. 2015. Ends. Theorizing the contemporary, *Cultural Anthropology* website, September 24, 2015. https://culanth.org/fieldsights/713-ends.
———. 2016. *Democracy's infrastructure: Techno-politics and protest after Apartheid*. Princeton University Press.
Warner, Michael. 2002. Publics and counterpublics. *Public Culture* 14: 49–90.
Weizman, Eyal. 2012. *Hollow land: Israel's architecure of occupation*. New York: Verso.
Weszkalnys, Gisa. 2014. Anticipating oil: The temporal politics of a disaster yet to come. *Sociological Review* 62(S1): 211–235.
White, Leslie. 1943. Energy and the Evolution of a Culture. *American Anthropologist*, 45(3): 335–356.
Williams, Raymond. 1973. *The country and the city*. New York: Oxford University Press.
Winner, Langdon. 1999. Do artifacts have politics? In *The social shaping of technology*, ed. D. A. MacKenzie and J. Wajcman, 26–39. Buckingham, UK: Open University Press.
Wolf-Meyer, Matthew. 2012. *The slumbering masses: Sleep, medicine, and modern American life*. Minneapolis: University of Minnesota Press.