Article

Science, Technology, & Human Values
1-19

DOI: 10.1177/0162243915620017
sthv.sagepub.com
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Paradoxical Infrastructures: Ruins, Retrofit, and Risk

Cymene Howe[1], Jessica Lockrem[1], Hannah Appel[2], Edward Hackett[3], Dominic Boyer[1,4], Randal Hall[5], Matthew Schneider-Mayerson[4], Albert Pope[6], Akhil Gupta[2], Elizabeth Rodwell[1], Andrea Ballestero[1], Trevor Durbin[7], Farès el-Dahdah[8], Elizabeth Long[9], and Cyrus Mody[10]

Abstract

In recent years, a dramatic increase in the study of infrastructure has occurred in the social sciences and humanities, following upon foundational work in the physical sciences, architecture, planning, information science,

[1]Department of Anthropology, Rice University, Houston, TX, USA
[2]Department of Anthropology, University of California, Los Angeles
[3]Heller School for Social Policy and Management, Brandeis University, Waltham, MA, USA
[4]Center for Energy and Environmental Research in the Human Science (CENHS), Rice University, Houston, TX, USA
[5]Department of History, Rice University, Houston, TX, USA
[6]School of Architecture, Rice University, Houston, TX, USA
[7]Department of Sociology, Anthropology and Social Work, Kansas State University
[8]Humanities Research Center, School of the Humanities, Rice University, Houston, TX, USA
[9]Department of Sociology, Rice University, Houston, TX, USA
[10]History Department, Rice University, Houston, TX, USA

Corresponding Author:
Cymene Howe, Rice University, 6100 Main St., MS-20, Houston, TX 77019, USA.
Email: cymene@rice.edu

and engineering. This article, authored by a multidisciplinary group of scholars, probes the generative potential of infrastructure at this historical juncture. Accounting for the conceptual and material capacities of infrastructure, the article argues for the importance of paradox in understanding infrastructure. Thematically the article is organized around three key points that speak to the study of infrastructure: ruin, retrofit, and risk. The first paradox of infrastructure, ruin, suggests that even as infrastructure is generative, it degenerates. A second paradox is found in retrofit, an apparent ontological oxymoron that attempts to bridge temporality from the present to the future and yet ultimately reveals that infrastructural solidity, in material and symbolic terms, is more apparent than actual. Finally, a third paradox of infrastructure, risk, demonstrates that while a key purpose of infrastructure is to mitigate risk, it also involves new risks as it comes to fruition. The article concludes with a series of suggestions and provocations to view the study of infrastructure in more contingent and paradoxical forms.

Keywords
development, environmental practices, futures, alternative life forms, markets/economies, politics, power, governance, space/place/scale dynamics

Introduction

Breakdowns and blackouts, pipeline politics, and new demands upon energy and resources have surfaced infrastructure in surprising ways, igniting conversation about social and material arrangements that are often left submerged, invisible, and assumed. In recent years, we have witnessed a dramatic increase in the study of infrastructure in the social sciences and humanities, following upon foundational work in the physical sciences, architecture, planning, information science, and engineering. While the popular imagination might recognize infrastructure as the mundane mechanisms within, beneath, and supporting the maintenance of quotidian life, many scholars have foregrounded the agency, performativity, and dynamism of infrastructure. Infrastructure is not inert but rather infused with social meanings and reflective of larger priorities and attentions. To further engage these novel lines of inquiry, a group of scholars gathered at Rice University's Center for Energy and Environmental Research in the Human Sciences for an extended roundtable discussion. We came from a variety of academic institutions and positions in the academy (ranging from senior scholars to PhD candidates), and our group

reflected a diverse range of disciplinary backgrounds (American studies, anthropology, architecture, history, science and technology studies, and sociology). Our objective was to break down some of the scaffolding that upholds disciplinary boundaries. To embrace a starkly infrastructural metaphor, we were interested in "bridgework," not just to move from point A to point B, but to hold us in suspension for a time so that we might inspect the mechanisms that drive our intellectual work and scholarship. Infrastructure, which epitomizes the conjunction of material forms, expertise, social priorities, cultural expectations, aesthetics, and economic investments, seemed to us to be the ideal rubric through which to enrich our thinking, as well as a social object that necessitates a multidisciplinary approach. A collaborative conversation would help us to disentangle theories, concepts, and methods from their usual paradigms, permitting them to "recombine" in novel ways (Hackett and Parker 2014, 12). Our conversation was animated, in part, by other "turns" in the humanities and social sciences, including new materialisms, posthumanisms, and ontological approaches.

Walking through the dynamic scholarship on infrastructure that is being published in the human sciences, we were struck with the definitional capacity of the term itself. Infrastructure is material (roads, pipes, sewers, and grids); it is social (institutions, economic systems, and media forms); and it is philosophical (intellectual trajectories: dreamt up by human ingenuity and nailed down in concrete forms). Infrastructure has a capaciousness and scope that makes it both an infinitely useful concept and a concept that is open to facile misinterpretation or to being encumbered by overuse. Our purpose was not to produce yet another definition of infrastructure (although at the end of this essay we do offer a few potential classifications). Instead we gave our attention to questions such as "What is generative about thinking with and through infrastructures at this historical juncture?" And "How can the multiple and diverse understandings of infrastructure across the human sciences mutually inform and enhance one another?" Simply put, we wanted to unravel "why now?" and "where do we go from here?" Our hope was to work toward "explication" (Latour 1993; Sloterdijk 2009), knowing that infrastructure has moved from the background to the foreground, while remaining intent on questioning why that is so.

This collective essay gathers the themes and insights that echoed through our conversation. These issues were resonant points of return because they revealed the relational and ambiguous elements of infrastructure to produce contradictions and unevenly felt consequences in the lives and places they contact. We have codified these apparent paradoxes, broadly, into topical domains of ruins, retrofit, and risk.

Ruins

The constructive promise of infrastructure is its future orientation, its generative impulses (Harvey and Knox 2012). Yet we recognize that in many, if not most, cases we live and work among various kinds of ruined or faltering infrastructure. Many of the past projects and assurances of modernity have degenerated. We now see decay and breakdown where there once was grandeur and optimism, however fantastical or naively ebullient (Mitchell 2002; Larkin 2008); infrastructural deterioration highlights the affective investments and meanings associated with a particular set of projects over their lifetime (Schwenkel 2013). In the Global North, the Keynesian era had a surfeit of growth-oriented projects and emphasized multiplying infrastructures and employing human labor in the service of bettered conditions and "quality of life" (Nader and Beckerman 1978). Decades later, after a proliferation of neoliberal policies in which governmental provision of public goods and infrastructures has been reduced,[1] many of us who reside in the Global North live among the remnants: infrastructures that have been neglected, abandoned, and left to deteriorate.

But it is worth pointing out that deterioration as such is intimately tied to northern neoliberal forms of governance and experience; in much of the Global South a high-functioning Keynesian infrastructural apparatus never existed. It is important that we distinguish between infrastructure that has gone to ruin and infrastructure that never was. In some parts of the world, persistent infrastructural breakdown, or total absence, is the norm. Here we witness constant deferrals and unfulfilled hopes for material benefits as people wait or improvise in order to get hold of water, electricity, transport, digital communications, and other resources and services needed, or desired, for daily life. Infrastructure can also have direct negative impacts on populations, serving as a material channel for structural violence, war, and environmental catastrophes (Rodgers and O'Neill 2012). Thus, dramatic forms of ruination and infrastructural leakage such as Deepwater Horizon—dubbed "the largest accidental marine oil spill in history"—can be juxtaposed to creeping forms of ruination such as the annual oil leakage in the Niger Delta, which, in sheer quantity, surpasses Deepwater's blowout. Contingent circumstances and temporal scales are critical here. Where our attentions are drawn has much to do with our expectations of infrastructure in certain places and certain times. Historical studies of environmental justice controversies highlight the longtime role of differential political power in decisions about waste disposal infrastructure, for instance (Blum 2008; Bullard 2000). And sometimes it is local populations who live in the

"background" of infrastructures that are constructed solely to channel resources to other more distant populations. These sorts of seepages and disruptions draw attention to how permeable infrastructure is: appearing strictly utilitarian but always also embodying larger structures of power and direction (Graham 2010).

Infrastructure is rarely broken for everyone. Uneven provision and maintenance of infrastructure within cities, for example, lead to a splintering urbanism (Graham and Marvin 2001). In some areas of Mumbai, piped water may be available for only a few hours every day, whereas in other parts of the city, water may flow as needed at any time (Anand 2011; Sze 2015). Infrastructure is meant to facilitate human mobility, sustain life and labor systems, and provide convenience. But once in place, it also functions to bend human routines and material practices to its will (Pope [1997] 2015). Multinational oil corporations in Equatorial Guinea, for example, have built infrastructure-rich enclaves with all of the comforts of elite modern life; it is a stark illustration of infrastructural poverty and privilege that corporate sponsored development abuts urban areas that are bereft of basic infrastructural capacities (Appel 2012). In the Global North, we see transportation infrastructures being allowed to deteriorate and founder while in parts of East Asia, airports, high-speed rail, and subway systems are being built at a maddening pace. State investment in "prestige infrastructures," such as major redevelopments of luxury commercial and residential centers, or grand international architectural projects such as Beijing's Olympic "birdcage," can operate at the expense of local populations by diverting infrastructure investments or resettling populations (De Boeck 2011; Harms 2012). Given that infrastructure has long been the go-to mandate for developmentalist programs to foster ideals of progress and encourage economic growth (Masquelier 1992; Khan 2006; Harvey 2010), we might expect economic and social inequalities to surface where infrastructure does (or doesn't) go. After all, infrastructures are predicated on unequal divisions of labor that are conditioned through geopolitical inequities (Graham and Thrift 2007). Infrastructure continuously provokes questions among populations as to who benefits and who is made abject (Anand 2012). Infrastructural deficiencies can both index preexisting inequalities, just as they may, simultaneously, deepen those inequalities.

Infrastructure is also—in its nascent, constructive phase and, alternately, when it is clearly suffering debility—the object of intense political and economic debate (Ballestero 2015; Barry 2013). Examples of this abound in the United States and elsewhere, from the XL Pipeline to Beijing's attempt to dial down its airborne carbon and particulate load. Examining

infrastructure's breakdown and its effluvia requires a situated perspective that acknowledges certain types of insufficiencies as they exist at specific historical moments and geographical locations. It also demands recognizing the ways that infrastructure can function as a form of capital that interacts with other forms of capital, including natural, human, and social capital (Schneider-Mayerson 2015). Where resource extraction and massive construction projects signal the marriage of material and natural capital that portend depletions and precarious environments, other sorts of infrastructure, like Internet communication technologies, draw from and expand social and cultural capital. Juxtaposing qualitatively different sorts of infrastructure and their capital imprint, we found a perpetual, if unconscious, habit to qualify certain infrastructures as good and others as bad, often following the contours of natural versus artificial, decentralized versus centralized, arborescent versus rhizomatic, preformatted versus amorphous. While situated attention is critical in the study of infrastructure, it is eerily easy to lapse into categorization bias toward types of infrastructure that appear more promising than the failed. Those infrastructures that seem more hopeful—sustainable energy projects versus fossilized extraction, for instance—attract us even as we realize that a range of issues appear across each kind of infrastructural apparatus. Living in ruins is a conditional status, an attunement, and an awareness that we variously and differently inhabit.

Ruins and moments of breakdown make infrastructure visible to everyone involved; it is momentarily acute. This formed the thinking for our first paradox of infrastructure: even as infrastructure is generative, it degenerates. Infrastructures are, in a sense, reproductive systems that owe much of their capacity to human design, organization, and enablement. Yet the reiterative, productive quality of infrastructure is, oftentimes, taken for granted (Boyer forthcoming). When this potential breaks down, ruptures, or collapses, these assumptions of unending facilitation and flow come into question (Star 1999; Larkin 2013). Infrastructure is not always "infra," it seems; it is visible, very visible, precisely because, and when, it is breaking down. Designers of new infrastructures imagine them as "future proof" and universally applicable, and yet real-world systems are invariably particular and "future vulnerable" (Edwards et al. 2009, 371). In short, infrastructure seems to project itself into the future, but it cannot possibly endure. A lesson of infrastructure is that it surfaces the social conditions and times in which it is sited; thus, it demonstrates as much about our historical and cultural attentions in a particular moment and place as it does about the thing itself.

Ruination calls attention to both the constructive and destructive nature of infrastructure. Ruins remind us that infrastructures have the potential to

offer numerous benefits but that they are also ultimately incapable of forever satisfying the tasks they are meant to carry out. Infrastructure enables flows of goods, people, and ideas (Larkin 2013). It often inhabits the background, or serves as a scaffolding, channel, or mechanism for other kinds of work to occur and unfold (Star 1999). As Bruno Latour argues, these sorts of construction sites create an experience and a feeling that is "troubling and exhilarating" and a sense that "things could be different, or at least that they could still fail" (2005, 89). Rather than viewing failure or ruination as a deformed teleology or ruptured purpose, we see these conditions as constitutive. At the construction site, the temporality of ruins is inverted. As a "ruins of the future," the construction site occupies a temporal space between the hopes pinned upon future infrastructures and the actualization of that promise. This is not only a transitional state, but a condition in its own right, a space between the past and the future (Gupta 2013).[2] In practice, this means that the study of infrastructure is just as often a project of construction (rather than deconstruction) and in turn, one that calls for analyses that are able to view the multiple material, semiotic, and temporal operations of infrastructure.

Retrofit

Infrastructure conveys both material solidity and durable functionality. Yet infrastructure is only variably durable and solid; for those working directly with infrastructural projects, these seemingly adamantine structures may feel malleable, fragile, or vulnerable (Star 1999). In order to operate over long periods of time, old infrastructural designs must be constantly retrofitted to meet new contingencies. With retrofit, infrastructure conjures a second paradox as it appears to be an ontological oxymoron: retrofit is an attempt to bridge timelines—from the past to the present and from the present to the future—but the need to retrofit, retool, and refurbish infrastructures makes clear that infrastructural solidity, in material and symbolic terms, is more apparent than actual.

Common sense tells us that infrastructures are rigid: pipes, roads, poles, and stations. And yet infrastructure also necessitates the "softer" powers of human skills, competencies, and expectations. In this way, infrastructure is "sticky," even as its materiality may feel impenetrable. The built and hardened condition of infrastructure can be juxtaposed against the inevitable degeneration of its matter over time—its fragility in the face of chemicals, water, weather, and use. But the apparent solidity of infrastructure is also the place where one finds the clear intersection of human intention and

material life. Because infrastructures are layered and complex, infrastructure must be changed in modular increments, involving negotiation with other aspects of the system (Star and Ruhleder 1996). The work of retrofitting is complex and uneven. As needs, desires, and technology change over time, altering and updating become an integral part of infrastructural development. The inability of an infrastructure to "grow"—or to change and adapt to new environments—is one reason infrastructures meet their end or fall into disuse (Edwards et al. 2009). Paradoxically, the intentional sturdiness of many infrastructural projects often makes retrofitting impractical, costly, and often politicized.

Infrastructure has a certain set of presumptions regarding the future built into it. Infrastructures decay and call for constant and assiduous maintenance in order to function over time, work that is often hidden from view but reveals the importance of human labor and creativity for these systems (Henke 2000; Graham and Thrift 2007). Even the more liquid-like channels of infrastructures—digital flows, airborne signals, and oceanic shipping routes—mandate retrofit as technology and demands for data and goods ebb and flow. The opening of Arctic polar shipping routes is an example of this sort of (re)newed flow, one that is both "natural" and "man made"—carved by climate warming and deeply dependent on capital for its utilization. Likewise, information infrastructures are perennially evolving systems, often originating through connecting isolated systems through "gateways" (Edwards et al. 2007) and requiring flexibility, yet standardization, to function and survive (Hanseth, Monteiro, and Hatling 1996). Maintaining infrastructures draws attention to their incapacities, but it also opens to the possibilities of new technologies to satisfy new needs and new wants. In the case of energy infrastructures, for example, climate change and fluctuations in oil markets either are provocations to adapt and retrofit older infrastructures to new realities or are cause for imagining entirely new systems to fuel the flow of contemporary life. The long lead times of some technologies—like large-scale energy infrastructure—also require an extended gestation in their "imaginary" form. Desertec, for example, the plan to paper the Sahara with solar panels in order to provide renewable electricity to parts of North Africa and Europe, is already decades in formation. If and when it is implemented it will cast decades-long shadows and effects (Moore 2015). In an example closer to home, one of our participants reflected on a field trip to a local coal-fired power plant that he took with a group of undergraduate students. The students remarked, "Once you build this you're sort of locked-in to 50 years of coal .... That is going to be operating for a long time." They were, overall, deeply cognizant of infrastructural

duration and keenly aware that infrastructural decisions are a commitment. Moreover, they are a pledge to a mode of power and its consequences that, if they might have been ignored in the past, no longer can be. If infrastructure was previously submerged except in times of want and lack, with the growing awareness that planetary systems are being radically altered by our energy practices, infrastructure is increasingly positioned front and center. It has become a "front of the mind issue" (Giddens 2009) that appears increasingly perilous and indefensible.

Much of the scholarship on infrastructure in the social sciences has focused on the breakdown and creative repurposing of infrastructure. Vertesi (2014), for example, uses the analytical vocabulary of "seams" to examine actors' creative efforts to work across multiple heterogeneous infrastructures within a multi-infrastructural space. Studies on maintenance and repair draw attention to the care that is necessary to maintain an appearance and performance of stability for sociotechnical arrangements that are otherwise fragile and vulnerable (Denis and Pontille 2014, 2015; Jackson 2014). But there has been much less attention to comprehensive retrofitting. Retrofitting demands that we take temporality into account at every instant. It necessarily looks to past projects—failed or successful—to foresee what comes next. Retrofitting has a futurological orientation that has us thinking into the horizon while building from the materials and technologies of the present. With the advent of what has been dubbed the Anthropocene[3]—unprecedented human impact upon earth's terrestrial, aquatic, and atmospheric conditions—the relationship between timescales and infrastructural potential is intimately entangled (Howe 2014). The apparent human inability to manage temporality (especially in regards to the climate outcomes of industrialism) asks a lot from infrastructures of the future but necessarily so. In retrofit then, we find the anticipatory work of infrastructure as well as the ambivalences that emerge when existing projects are touted to enable an uncertain future.

Risk

Infrastructures, paradoxically, both mitigate and magnify precarity in the Anthropocene. Partially because of the vibrant discussions on posthumanism across the social sciences, our conversations about infrastructure continually returned to the anthropocentric orientation of infrastructure. Infrastructure is largely designed by humans for human purposes; we shape it and it shapes us (Lockrem 2016). Infrastructure is intended to enable certain behaviors, principles, and priorities, and it demands others of us. Infrastructures like roads and dams allow for the creation of things, but they are

also destructive of other things. Even as we locate and develop infrastructures with the goal of conserving the natural environment or utilizing nature as infrastructure (Carse 2012), as in the case of bounded reserves or more ecologically driven technology, this is often only the case due to prior human degradation of environmental conditions. Particularly as we confront the ends of certain kinds of energy and climate capacity, infrastructure comes with the recognition, in bleak terms (and as several of our participants put it), "the infrastructures of modernity are killing us." Infrastructure is compelling now, in part, because it offers a commentary on modernity and humanism.

The overtly human-centered orientation of infrastructure led us to our third paradox: the purpose of infrastructure is to mitigate risk, yet it also introduces new risks. Modern infrastructures have eased the challenges inherent in population growth and densely occupied cities, for example, allowing for safe disposal of sewage, efficient circulation of people and goods, and provision of water, to name a few. Yet, the more these infrastructures are taken for granted, the more difficult it is to prepare for and anticipate their failure. And, as infrastructures and social institutions are increasingly interwoven, the failure of one often leads to a cascading failure of multiple systems (Sims 2007a, 2007b; Graham 2010). Infrastructures can foment dangers when they are instituted without regard for human equality or natural processes. The military industrial complex and infrastructures of war are prime examples. Just as infrastructures elevate some, they can create marginalized populations elsewhere (Hall 2012; Montrie 2003). In our increasingly technological societies—and the resulting necessity of technological interactions—populations are increasingly evaluated in terms of intellectual productivity and knowledge (Barry 2001). One person's benevolent infrastructure can be another person's burdensome barrier (Star 2002, 16). Infrastructures produce consequences that are both selectively inclusionary and exclusionary, silencing one point of view while applauding another (Bowker and Star 1999).

One of the most insidious effects of overabundant (albeit unevenly distributed) infrastructure is global climate change; just as infrastructure has been imbalanced in its installation, so too have climatological consequences been disproportionately felt. Infrastructure managers and planners are now starting to recognize that the old "predict and provide" models that result in endlessly multiplying infrastructural capacities to meet ever-increasing demand are no longer environmentally, economically, or politically desirable (Evans, Guy, and Marvin 1999). As climate models and predictions of catastrophic futures occupy headlines and belabored international

conferences and agreements, it is clear that our species' history has arrived at a pan-species juncture of reckoning (Chakrabarty 2009). In contemporary concerns about climate change, extreme weather events, and atmospheric shifts, we are increasingly compelled to turn our attentions skyward (Howe 2015). This, in turn, seems to have us equally occupied with gazing down and around at the infrastructural mechanisms, routes, and channels that have led us here: stuck, for the moment, in carbon.

Looking at infrastructure, particularly in a time of ecological crisis (or at the very least, concern), is also an opportunity to reevaluate what we intend by infrastructure. Therefore, in a more philosophical register meant to further counter a split between Nature and Society, we questioned whether we can talk about infrastructure "all the way down." That is, where does infrastructure end and where does it begin? What are its boundaries and ontological properties? The infrastructures that we build, for instance, are situated some*where* in space and time. But is that somewhere, often a collection of materials and organisms, a part of infrastructure or distinct from it? Or, put another way, might infrastructure be defined over and against its negative space, that is, in the places where it's *not*? Where infrastructure meets and conjoins with the organic, the ecological, and the hydrological, we find spots of corrosion, melt, and leakage where one becomes a part of the other. It appears sometimes as though infrastructure might well be inseparable from the (so-called) natural, geological, atmospheric, or biological setting in which it is sited (Carse 2012). When signal melts into air, infrastructures appear to appropriate the physical capacities of their medium, rather than serving simply as a channel for other media. Infrastructure can be recombinant.

In a more pragmatic vein, we can also see dynamic transformations in the relationships between human-made infrastructure and environmental spaces. Massive marine protected areas, for instance, are meant as a form of ecological infrastructure to protect oceanic reefs (Durbin 2015); and in turn reefs come to be seen as ecological infrastructures, or in the most marketizing terms "environmental services." Natural systems themselves—gullies and estuaries, rockslides, and erosion—are all ways that water and materials are stored, diverted, and channeled. Historically, we humans have gained much of our infrastructural acumen from observing the processes of the environments around us. This habit has now been formalized and made fashionable with the rise of biomimicry. As we collectively acknowledge that infrastructures facilitate the exploitation of natural resources, pollution of environments, and other detrimental effects on a geological scale, our solutions, ironically, also tend toward the infrastructural. Infrastructures

that have made the present world possible are also the source of climate change, ocean acidification, invasive species dispersal, and other deleterious effects. While modified systems create renewable energy, efficient mass public transit, or reduce consumption, we must ask about the ruins of these future infrastructures. Will their retrofit requirements be flexible enough to adapt to unknown nexts? Is our infrastructural imaginary more sage than it was, and can our engineered apparatuses succeed in the task? Questions such as these are perhaps not quite yet ready to be answered. But there is an opening here, we found, that was related to the unfinished qualities, or nature, of infrastructure. Infrastructure may be that which is built knowing that it will become obsolete, and in that vein, it is never finished. Infrastructures that are taken as undone or an eternal work in progress may have the possibility of an organic relationship to the situation and context that they are infrastructuring. We like to imagine an infrastructure that is receptive to feedback from biological or natural systems: a more ecologically communicative infrastructure.

Infrastructure as Paradox

The capacity to be many things with many properties appears to define infrastructure as an object. Throughout our conversation, each turn led us to new definitions and interpretations. And this, we believed, was a good thing—but not one without the peril of creating a signifying apparatus that would mean everything and nothing all at once. Infrastructure is that which lies within or beneath a structure. It is a thing that allows for the circulation of other things, mediating resources and smoothing the function of capitalist transaction. But infrastructure also often represents the "good life," dreams of equality and access. Infrastructure is physically constructed, the manifestation of material culture, except when it is not, as in many communicative and epistemic infrastructures. Although material and informational infrastructures are often inextricably bound up in their mutual production (Barry 2013), infrastructure is "by definition invisible, part of the background for other kinds of work" (Star 1999, 380). Yet, in many instances, the visibility of infrastructure is necessary to assert its political and poetic effects (Larkin 2013). It is built to endure, except when it fails, breaks down, or ends in disaster—as in Fukushima Daiichi. Infrastructure is designed by and for humans, except when it is not: as with a stream, an estuary, or a forest (Jensen and Morita 2015). Infrastructure supports structures, but it is also structure in and of itself. Infrastructure is an active site of maintenance and retrofit but also bound to its internal systematicity and program. It is a thing

and it is a relationship. Describing anything as infrastructure is, we agreed, a certain kind of categorical act.

Our continual resuscitation of the question "what is infrastructure?" pivoted upon its paradoxical qualities: generative and degenerative; constructive and destructive; future oriented but ultimately fleeting; fluid and mobile yet inflexible; and sometimes obdurate to retrofitting. Infrastructure has enabled and accelerated many of the effects associated with the Anthropocene, and yet infrastructure might be the best way to ameliorate our contemporary predicament. In this moment, it appears that we are able to unearth infrastructure in ways that we might not have before; by questioning its inherent character as *infra*, we have encountered its externalizing effects. The view that infrastructure is simply the scaffolding for, rather than constitutive of, our current environmental and energetic conditions appears increasingly dubious. Any theory of infrastructure, then, ought to be a theory of paradox. The paradox of infrastructure is its double quality as both solid and durable and evaporative and itinerant; it is built and grown, rigid and fluid, meant to last but doomed to be outmoded, ruined, and exceeded. Therefore, it is in these nodes of paradoxical intermingling and entanglement that we can rethink the complexity of infrastructure; its realization is only the limit of our collective imaginary. Its mutability lets us reach real-world phenomena that crosscut different kinds of disciplinary interests. Thus, infrastructure, even its most capacious form, continues to call for conversations in the human sciences in ways that other concepts and works might not, especially as our ruins demand retrofit in a time of ever greater risk.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The seminar that gestated this article was sponsored by Rice University's Center for Energy and Environmental Research in the Human Sciences.

Notes

1. Telecommunications and Internet infrastructures are a clear exception although it could be argued that they too have further facilitated the flow of neoliberalism and increased marketization.

2. Archeologists might make a similar claim that (ancient) infrastructures are simply future ruins.
3. Anthropocene remains a contested term in the social sciences; neither is it fully qualified by geologists. See, for example, Steffen, Crutzen, and McNeill (2007).

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Author Biographies

Cymene Howe is an Associate Professor and Director of Graduate Studies in the Department of Anthropology at Rice University. She is the author of *Intimate Activism* (Duke 2013), *Ecologics: Wind and Power in the Anthropocene* (forthcoming) and she currently co-edits the journal *Cultural Anthropology* and the *Johns Hopkins Guide to Critical and Cultural Theory*. Her current research, Melt: The Social Life of Ice at the Top of the World, examines cryohuman relations in the Arctic and the adaptive entanglements of the Great Melting.

Jessica Lockrem is a PhD Candidate in the Department of Anthropology at Rice University. Her dissertation, *Moving Ho Chi Minh City: Planning Public Transit in the Motorbike Metropolis*, examines the role of speed in contemporary urban life through an ethnography of transportation systems, both current and imagined, in Vietnam's largest city.

Hannah Appel is an Assistant Professor of Anthropology at UCLA. Focused on the daily life of capitalism and the economic imagination, her current book

manuscript–*Futures: Oil and the Licit Life of Capitalism in Equatorial Guinea*–dwells on questions of infrastructure, the contract and the corporate form, and the ethnographic life of something called a national economy.

Edward Hackett is vice provost for research at Brandeis University and a professor in the Heller School of Social Policy and Management. His current research is concerned with the dynamics and outcomes of transdisciplinary collaborations in diverse contexts, and he has written about peer review, environmental justice, and science policy.

Dominic Boyer is a Professor of Anthropology and the Founding Director of the Center for Energy and Environmental Research in the Human Sciences (CENHS) at Rice University. His research interests focus on media, knowledge, energy and power. He is the author of *The Life Informatic* (Cornell 2013) and has co-edited *Theory Can Be More Than It Used To Be* (Cornell 2015) and the *Energy Humanities Reader* (Johns Hopkins 2016).

Randal Hall is an Associate Professor of History at Rice University and editor of the *Journal of Southern History*. His research interests include the environmental implications of Americans' evolving discussions of scarcity and abundance.

Matthew Schneider-Mayerson is an Assistant Professor of Social Sciences (Environmental Studies) at Yale-NUS College. He is the author of *Peak Oil: Apocalyptic Environmentalism and Libertarian Political Culture* (Chicago 2015), and his research focuses on oil, climate change, happiness, and the political imaginary of the ongoing energy transition.

Albert Pope is an Architect in Houston, Texas and the Gus Sessions Wortham Professor of Architecture at Rice University. He has lectured, exhibited and written extensively on the logic of contemporary urban form and its decisive role in shaping social and environmental contexts and is the winner of several design awards. He is the author of *Ladders* (Princeton Architectural Press, 2014) and is the founding Director of Present Future, a design program and think tank at Rice University School of Architecture; he is currently engaged in a large scale planning Project named Carbon 2065.

Akhil Gupta is a Professor of Anthropology at UCLA and Director of the Center for India and South Asia (CISA). He is the author of *Red Tape: Bureaucracy, Structural Violence, and Poverty in India* (Duke 2012). His new research focuses on call centers and BPOs in India. He is also working on infrastructure, and an edited volume (with Nikhil Anand and Hannah Appel), *The Promise of Infrastructure* is currently under review.

Elizabeth Rodwell is a recent graduate of Rice University's anthropology department, and a Graduate Scholar awardee from The Image conference. She is currently working on a book manuscript, entitled "*Push the Button: Interactive Television and Collaborative Journalism in Japan*".

Andrea Ballestero is Assistant Professor of Anthropology at Rice University where she also runs the Ethnography Studio. She is interested in spaces where the law, economics and techno-science are so fused that they appear as one another. Her current research examines practices of valuation and differentiation of water in Latin America. She is also conducting ethnographic explorations of Underground Liquidities examining the peculiar volumetric politics of the subsurface world.

Trevor Durbin is an instructor of cultural anthropology in the Department of Sociology, Anthropology, and Social Work at Kansas State University where he teaches environmental and medical anthropology. His research is concerned with political ecologies of large-scale marine biodiversity conservation in Oceania.

Farès el-Dahdah is Professor of the Humanities and Director of the Humanities Research Center at Rice University. With the support of the Andrew W. Mellon Foundation, el-Dahdah is currently leading a John E. Sawyer Seminar on the Comparative Study of Cultures titled, *Platforms of Knowledge in a Wide Web of Worlds: Production, Participation, and Politics* as well as a Public Humanities Initiative. His current research interests focus on online historical mapping projects that describe cities over time, as they existed and as they are at times imagined.

Elizabeth Long is Professor Emerita in the Sociology Department at Rice University. Her scholarship was centered on the sociology of culture and gender (e.g. *Book Clubs*, 2003). More recently, her research and teaching have engaged with environmental issues, community resilience and local movements towards sustainability whether in higher education or among anti-fracking activists in upstate New York.

Cyrus Mody is Professor and Chair in the History of Science, Technology, and Innovation at Maastricht University. He is the author of *Instrumental Community: Probe Microscopy and the Path to Nanotechnology* (2011) and *The Long Arm of Moore's Law: Microelectronics and American Science* (forthcoming). His current projects examine how the cultural and economic dislocations of the 1970s in the United States and Western Europe gave rise to new high-tech industries and institutions for research.