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Infrastructural politics amidst the coils of control

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ABSTRACT



From contaminated water pipes to social media manipulation to sinking cities, infrastructures increasingly appear at the heart of cultural, political, and environmental crises. As a technique of governance, infrastructures delegate control to systems and disperse power into the environment. This special issue argues that engaging with infrastructural politics requires new tactics and modes of analysis which take seriously the politics of articulation, everyday life, and meaning. The introductory essay situates the project of infrastructural politics within the critical and cross-disciplinary literature on infrastructure and the political tradition of Cultural Studies. We identify distinctive features of infrastructural politics, organized around the concepts of scale, formalization, and imaginary, that set forth the common concerns of the issue and raise questions for future research. Following this discussion, we introduce the essays of the issue, spanning topics that include emergency dispatch, automated music mastering, open pit coal mines, homeless encampments, police body cameras, and sand. Throughout, the issue is animated by a commitment shared among founding figures of Cultural Studies, activists, and abolitionists: the capacity to critically engage infrastructure in order to improve the lived conditions of culture.

KEYWORDS control; imaginary; infrastructure; platform; sts; technology

Introduction

It was slow in coming to us, in all its effects, but steam power, the petrol engine, electricity, these and their hosts of products in commodities and services, we took as quickly as we could get them, and were glad ... in the new conditions, there was more real freedom to dispose of our lives, more real personal grasp where it mattered, more real say. Any account of our culture which explicitly or implicitly denies the value of an industrial society is really irrelevant; not in a million years would you make us give up this power. —Raymond Williams (2000 [1958], p. 97)

Writing in the middle of the twentieth century, Raymond Williams describes culture as a whole way of life profoundly shaped by infrastructure. From the

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energy systems referenced in the epigraph to the communication and transportation networks discussed elsewhere in the essay, infrastructures make possible (or impossible) particular ways of living. The meshwork of modernity under discussion comes to life through Williams' story of returning home to the 'beautiful farming valley' in Wales, a story peppered with references to cinemas, cathedrals, buses, bridges, mills, gasworks, roads, and railways. These aspects among others represent the 'gifts' of the Industrial Revolution to the Welsh working class, an account that sharply contrasts with the enduring idea of culture as the valorization of traditional ways of living, tied to the land, whose values must act as a bulwark against the moral ruination purportedly endemic to industrialization. Drawing upon personal experience growing up in a place presumed closer to this mythical past, Williams argues that the narrative fails to grasp the material benefits and progress wrought in and through industrial infrastructures, and 'not just mechanical external progress either, but a real service of life' (2000 [1958], p. 97). Out of these observations and commitments, Williams outlines a conceptualization of culture concerned with everyday experience and the material manifestations of power that misses the mires of idealized approaches, whether focused on traditional ways of living or the standards of high culture.

This special issue adopts a similarly expansive understanding of culture grounded in the everyday, along with the recognition of infrastructures as agents of power. And, where there is power, there is politics – an inheritance that Williams gestures towards when discussing the claim that power brings ugliness. Although acknowledging problems of cramped cities and environmental degradation, Williams rejects the inevitability of the premise and frames such costs as the consequence of 'stupidity, indifference, or simply incoordination' (p. 98). The problems surrounding contemporary infrastructure offer ample evidence of ugliness, attributable in part to accident and ignorance. Whether contaminated water pipes in Flint, Michigan, or the manipulation of elections on social media platforms, or the sinking of coastal cities like Jakarta, infrastructures increasingly appear at the heart of cultural, political, and environmental crises. However, not all harms are accidental accomplishments, and some systems, working exactly as intended, are decidedly not in the 'service of life.' This is because infrastructures are inescapably partisan, distributing resources, shaping public life, and encoding values. Infrastructures are also a major locus of political practice, providing a motivation for and means of organizing. Understanding infrastructure simultaneously as a technique of governance, a means of existential support, and a site of contestation brings us to the project of infrastructural politics, collectively enacted through the components of the special issue and articulated here in the introduction. In what follows, we situate the project within critical literature on infrastructure and the political tradition of Cultural Studies, arguing that infrastructure constitutes a model of control over meaning

and material resources; we present and develop the concepts of *scale*, *formalization*, and *imaginary* for infrastructural politics; and we introduce the essays of the issue. Throughout, we are animated by the promise of the politics expressed in Williams' essay 'Culture is Ordinary' and echoed in the work of activists and abolitionists: the capacity to critically engage infrastructure in order to improve the lived conditions of culture.

Situating infrastructural politics

In 1980, Langdon Winner posed the question 'Do Artifacts Have Politics?' and offered a resounding affirmation: yes, artifacts ranging from tomato harvesters to overpasses to nuclear power plants participate in the arrangement of power and authority. The answer is less provocative today, although the devilish details remain widely disputed, including which artifacts, what kinds of participation, and how best to respond. As the references to transportation networks and energy systems suggest, we are indebted to Winner's work even as we have reformulated the project to focus on infrastructures (a particular set of artifacts, to be sure) and an understanding of politics informed by the Cultural Studies tradition, concerned with articulation, everyday life, and meaning as a site of contestation. We thus situate the special issue in two intellectual lineages, one associated with infrastructure and the other with a particular formulation of politics.

Studying infrastructure across sites and disciplines

Infrastructure is a relatively recent addition to the English language, first appearing in the 1920s and treated as a specialized term, regularly set off in quotation marks, through the 1960s (Batt 1984, Carse 2017). The formulation of infrastructure as an object of social and political concern is still more recent, picking up steam over the course of the twenty-first century thanks to macro-processes of privatization, liberalization, and globalization (Graham and Marvin 2001); the growing ubiquity of information technology (Edwards *et al.* 2009); and the challenges climate change poses to existing infrastructures and to existence itself (Harvey *et al.* 2017). From Brian Larkin's eloquent anthropological review (2013) to the collaborative call to integrate infrastructure and platform studies (Plantin *et al.* 2018) to Lisa Parks and Nicole Starosielski's materialist vision of media infrastructure studies (2015), large networked systems appear at the heart of multiple exciting and emergent research agendas. Prominent publications, special issues, and edited collections alike attest to an interest in infrastructure that spans the humanities (e.g. Peters 2015), social sciences (e.g. Anand *et al.* 2018), and the field of information science and computing (e.g. Edwards *et al.* 2009). Despite the diversity of methods and modes of analysis, this body of

work shows how the infrastructural vernacular has expanded to encompass the ordering of society, even as it has retained the early and eminently mundane concerns with technology and organization.

A growing awareness of the political significance of material systems accompanies the 'infrastructural turn' (Graham 2010). As 'matter that enables the movement of other matter' to borrow Larkin's characterization, infrastructures *matter*, although the meaning of this observation tends to depend on disciplinary positioning or the particular kind of infrastructure involved (2013, p. 329). Looking to the literature, we learn that information infrastructures contribute to 'fundamentally new ways of knowing' (Bowker *et al.* 2009), energy infrastructures 'sustain political and economic power' of nation states (Bridge *et al.* 2018), and urban infrastructures 'help to define the identity and locality' of a place (Graham and Marvin 2001, p. 9). Perhaps more concerningly, we learn that infrastructures present 'archaeologies of differential provisioning' involving material traces of the allocation of benefit always accompanied by harm (Anand *et al.* 2018, p. 27, 3), participate in 'infrastructural violence' both active and passive (Rodgers and O'Neill 2012, pp. 406–407), and feature as an important tool of 'geopolitical histories and the machinations of capitalist crises' (Aouragh and Chakravarty 2016, p. 560). Although there is no shared consensus on the meaning of *infrastructural politics* – and indeed, such political claims are rarely in direct dialogue with each other – critical studies of infrastructure make a strong case for the high stakes of 'the basic, the boring, the mundane, and all the mischievous work that takes place behind the scenes' (Peters 2017, p. 33).

Despite the conventional divisions between media, information, urban, and energy infrastructures, the expanded incorporation of information technology increases the commonalities among systems and subsequently blurs the boundaries between them. Awareness of this development entered popular culture in the 1990s with talk about the 'information superhighway', a metaphor that 'deliberately coupled the older hardware of urban civilization to rapid digital convergence' (Edwards *et al.* 2009, p. 365). More recently, smart infrastructure initiatives have sought to materialize the metaphor, integrating sensors and analytics in 'physical infrastructure in order to achieve real-time monitoring, efficient decision-making and enhanced service delivery' (Ogie *et al.* 2017, p. 8). The visibility and recognition of convergence may be recent, but the processes of articulating information and infrastructure, Bowker *et al.* argue, go back at least 200 years and include the information gathering activities of the state, the rise of statistics, and the emergence of knowledge works, all essential components of 'traditional' infrastructure projects (2009, p. 114, see also Beniger 1986). Following this historical trajectory, we contend that the politics of infrastructure entails both the processes and arrangements of specific systems and a generalized account of infrastructure as a particular model of power and control.

The latter sense of infrastructural power, for us, connects with Gilles Deleuze's notion of the control society. Deleuze introduces the concept of control using a fictionalized scenario, borrowed from Félix Guattari, of a

city where one would be able to leave one's apartment, one's street, one's neighborhood, thanks to one's electronic card that raises a given barrier; but the card could just as easily be rejected on a given day or between certain hours; what counts is not the barrier but the computer that tracks each person's position and effects a universal modulation. (Deleuze 1992)

The account, first published in 1990, seems significantly more plausible than it must have at the time of publication given advancements in mobile technology, digital platforms, smart cities, ubiquitous computing, wearable devices, and even the creation of the World Wide Web. And though it is not the language that Deleuze uses, the control society can be read as a parable about the growing political importance of infrastructure. As Brian Larkin explains, Deleuze matches types of machines to types of societies 'and if the nineteenth century was built on industrial technologies of enclosure, the twentieth and twenty-first centuries are built on structures of control mediated through the computer' (2013, p. 339). While we would replace 'computers' with 'information' to indicate its broader applicability, the formulation encapsulates the argument for infrastructural politics. Where institutions and discrete spaces, such as the school, the family, the prison, and the factory, characterized disciplinary societies, the control society sees the rise of infrastructures that cross, connect, and blur institutions, necessitating new modes of analysis and intervention – or as Deleuze put it, 'new weapons' (1992, p. 4).

Articulating politics in the cultural studies tradition

Yet, new weapons need not come from nowhere. This special issue posits that Cultural Studies offers an understanding of politics particularly well-suited to engaging with infrastructural power. In this section, we introduce and adapt ideas of articulation, everyday life, and the contestation of meaning as part of a broader orientation to the political informed by foundational figures in the field.

Politics, infrastructural or otherwise, refers primarily to the arrangement of power in a particular time and place. While this can include conventional practices such as elections and legislation, the category encompasses a more expansive set of activities and actors. At the same time, expansive approaches to politics threaten to flatten the world; just because anything can be political does not make everything equally so. Articulation, as Jennifer Daryl Slack explains, refers to the 'structure and play of power that entail in relations of dominance and subordination' and provides a means of 'characterizing a social formation without falling into the twin traps of reductionism and essentialism' (1996, p. 113). Slack's account highlights two important

aspects: first, politics-as-articulation focuses on relationships, and second, those relationships always unfold within a social and historical context. This way of conceptualizing context, also known as a conjuncture, marks out a kind of meso-analysis that operates at the mid-point between a moment and an epoch (Grossberg 2019, p. 42). Neither the study of isolated incidents nor totalizing historical trajectories, conjunctural analysis is 'a practice, a process, a critical analytic' that offers a sense of what to look for without prescribing how to look (ibid). A defining feature of Cultural Studies, conjunctural analysis implies an analytic commitment to understanding significant relationships, while infrastructures involve the intentional creation of such relationships. In other words, infrastructures are articulating engines that make use of the material environment to establish preferred paths and points of connection. The task of infrastructural politics, then, is to assess the urgency and efficacy of systematized relationships and to situate systems within a given conjuncture.

While all this talk of systems might suggest a preference for abstract and unyielding structures, it is important to remember that systems both shape and are sustained by the ordinary and everyday. Another defining feature of Cultural Studies, 'almost too obvious to mention' as Lawrence Grossberg notes, is a belief in the importance of culture, the 'taken-for-granted ground of assurance that makes our actions possible' (2019, p. 40). And certainly, that which is taken for granted does not exist in isolation from structural considerations, whether through the 'naturalization' of infrastructure (Bowker and Star 2000, p. 196) or the structural qualities of experience. Raymond Williams's idea of 'structures of feeling' gives name to the latter sense, concerned as it is with 'meanings and values as they are actively lived and felt, and the relations between these and formal or systematic beliefs are in practice variable' (1977, p. 132). In Williams' account, habitual modes of conduct are not reducible to individual preference or personality and are instead constitutive of culture. In other formulations, everyday life is 'a problematic, a contested and opaque terrain, where meanings are not to be found ready-made' (Highmore 2002). Appeals to ordinary people and ordinary life can be a means of further normalizing dominant worldviews, while also a way to assert the interests and perspectives of marginalized positions. An infrastructural politics of everyday life should thus attend to the production of habitualized actions, thoughts, and feelings while remembering that any such production is inherently partial and perspectival.

What is true for habits of thought applies equally to matters of expression and interpretation. Attentiveness to meaning is perhaps the most widely-known political commitment of Cultural Studies, and for good reason given the prominence of cultural artifacts to everyday life and the global media industries. In response, the field has developed sophisticated ways to study a 'cultural text or artefact', including the analytic framework of the 'circuit

of culture' which brings together 'processes of representation, identity, production, consumption, and regulation' (du Gay *et al.* 2013, p. 3). Stuart Hall's influential model of communication is similarly concerned with the circulation and contestation of meaning, where processes of encoding and decoding act as critical moments of interpretive work (2001). It is no surprise to find infrastructure literally lurking at either end of the model since Hall is speaking of broadcast systems and speaking to mass communication research (2001, p. 165). The significance of meaning is likewise easy to imagine for other media and communication infrastructures, where messages and texts abound. However, the boundaries of what counts as a 'text' have long been flexible, and we contend that the fight over meaning also applies to other kinds of infrastructures. In doing so, we find ourselves, and our formulation of infrastructural politics, keeping good company with Lucy Suchman's 'technomethodology' (1987), Steve Woolgar's analysis of 'the machine as text' (1991), and Susan Leigh Star's ethnographic exploration of the 'master narratives' of infrastructure (1999). A politics of infrastructure should not only concern itself with the movement of matter and the allocation of resources, but also with the management of meaning, including the identities of places, the proscription of roles, and promises of political transformation.

In outlining an orientation towards infrastructural politics, we do not wish to suggest that we are the first or only Cultural Studies practitioners to grapple with this subject matter. Indeed, Ted Striphas's inaugural statement as the editor of this journal featured an ode to the infrastructure that has sustained the field so far and a call for future modes of care (2019). We also find infrastructural foundations in Cultural Studies scholars like James Hay (2004), Jeremy Packer (2008), Jonathan Sterne (2012), James Carey (1992), Lisa Parks (2005), and J. Macgregor Wise (1998), to name but a handful. Although infrastructure is not always named as such, their work collectively demonstrates a commitment to examining the technological configurations of culture. Among more recent cultural studies of infrastructure, promising theoretical developments include James N. Gilmore and Bailey Troutman's 'agri-cultural approach' (2020); Rebecca Coleman's 'infra-structures of feeling' (2018); Annemarie Iddins's analysis of how digital rights activists imagine media infrastructures in surveillant states (2020); Lauren Bratslavky, Nathan Carpenter, and Joseph Zompetti's 'infrastructures of incivility' (2020); and Christopher Miles' historicization of algorithmic rationality within the legacies of industrial production (2019).

Unifying concepts

Following Deleuze, we contend that the growing political importance of infrastructure reflects an emerging configuration of power – control –

delegated to systems and dispersed into the environment. However, we can only follow Deleuze so far. The sketch of control societies featured in the 'Postscript' is more provocative than comprehensive, suggesting potential sites for future analysis clustered around institutional crises: 'The socio-technological study of the mechanisms of control, grasped at their inception, would have to be categorical and describe what is already in the process of substitution for the disciplinary sites of enclosure, whose crisis is everywhere proclaimed' (1992, p. 7). To understand the politics of infrastructure, then, we might start by looking at social substitutions, including the platform for community (e.g. Monahan, this issue), the camera for accountability (e.g. Reynolds, this issue), the algorithm for management (e.g. Ferrari and Graham, this issue). Such analogous arrangements represent the installation of novel system of power and governance, neither better nor worse than preceding systems, yet necessitating new political strategies and conceptual frameworks. As the short essay concludes, 'The coils of a serpent are even more complex than the burrow of a molehill' (Deleuze 1992, p. 7).

To move beyond the metaphorical serpent to actionable accounts of control, we synthesize existing literature and the articles of this special issue to present the three aforementioned concepts of infrastructural politics: scale, formalization, and imaginary. In so doing, we follow Cultural Studies' commitments to conceptual contextualism, or the idea that theoretical concepts should be grounded in empirical conditions. As Grossberg and Slack explain, 'while many intellectuals are comfortable with the necessary contextuality of empirical accounts, it is more difficult to accept that theories (and concepts) have to be approached similarly, as contextually specific tools or interventions' (2016, p. xi). Thus, scale, formalization, and imaginary do not offer abstracted and universal accounts of the politics of infrastructure – there are no one-size-fits-all solutions to contemporary problems. Instead, each concept offers a sensitizing lens for analysis, an associated set of questions to make sense of the serpent's coils, or the politics of infrastructure in any given case.

Scale

Discussions of the political significance of infrastructure, from transportation systems to digital platforms, frequently appeal to the scale of such projects, and with good reason. As Plantin and Punathambekar (2019) explain, scale and indispensability are 'properties typical of infrastructures' that contribute to their social, cultural, and economic significance. Prior to the current cross-disciplinary interest in infrastructure, electrical grids and communication networks might have been conceptualized as 'large technological systems' instead, bringing a concern with scale to the front and centre (Hughes 1987). As built systems that endure over time and extend across space,

infrastructures mediate between scales, connecting local practices with global systems (Star and Ruhleder 1996, p. 114). Of course, local practices do not always align with global standards, a perennial source of political friction and a familiar situation for anyone that has experienced the introduction of a new learning management system or other workplace software solutions. Additionally, through the twinned imperatives of connectivity and decontextualization, infrastructures challenge conventional boundaries, including national borders. Global efforts at Internet governance are the most obvious example of the regulatory difficulties involved, although less visible ‘distributional consequences’ across remote and often opaque networks perhaps pose even thornier problems (Jackson *et al.* 2007). Such systems confound conventional claims to accountability both epistemically, in terms of the difficulties of knowing the systems that produce our world, and legally, in terms of systems that assign responsibility based on individual action.

Scalar troubles are both spatial and temporal, connecting places and periods. Many of the large-scale systems associated with the ‘modern infrastructure ideal’, such as electricity grids, train tracks, and telegraph (and later telephone) lines, have world-shaping significance that lasts far beyond the initial construction, or even utilization, of the system (Graham and Marvin 2001). The establishment of one network shapes the likely creation of another, a situation dramatized by Nathan Ensmenger’s comparative mapping of Bitcoin activity, electrical grids, nuclear power plants, and train tracks in the United States that reveals how the ‘Information infrastructure of the twenty-first century is built around the bones of the nineteenth-century transportation and communication networks’ (2018, p. 19). The persistence of infrastructure demonstrates the importance of path-dependencies and early interventions, challenging the purpose and standards of a project before it becomes stuck in place. However, such persistence across time is not predetermined but rather produced through the labour of maintenance and repair (Jackson 2014). This is equally true for infrastructures and the temporalities they support. As Sarah Sharma argues, ‘temporalities are not times; like continually broken clocks, they must be reset again and again’, shaped by labour (2014, p. 8) and logistical media (Peters 2013, Gilmore 2017). The comparatively slow-moving modernity represented by older networks clashes with the accelerating and ever-iterating imperatives of digital platforms, destabilizing the systems designed to sustain everyday life (see Monahan; Velkova, this issue).

Formalization

Where the concept of scale attends to the physical form of infrastructure, articulated across time and space, formalization foregrounds the symbolic abstractions on which systems depend and the social arrangements they

support. In the first sense of the term, formalization fits alongside processes of informatization, classification, and standardization – each concerned with the particular account of the world built into a given structure. Classifications, as Bowker and Star argue, have consequences, especially classifications that are part of the ‘installed base’ of an infrastructure (2000, p. 35). In its digital iterations, formalization connects infrastructural politics to critical algorithm studies (e.g. Galloway 2004, Hallinan and Striphas 2016, Seaver 2017). For digital infrastructures, the importance of formalization is evident in its foundation of 1s and 0s, yet the concept is equally relevant to other technological systems that still require significant information gathering and management, such as mapping the land before laying railroad tracks. Following the long trajectory of information and control (Peters 1988), we find the politics of formalization equally applicable to computers and bureaucracies, code and legal regulations. However, as information technology is increasingly incorporated across all kinds of infrastructures, the possibilities for what can be formalized expand and the techniques involved grow more complex. Whether formalizing a place through a map or a person through code, constructs built into systems materialize values and political commitments – a point dramatized by the absence of Palestine on Google Maps or the demographic categories built into a census.

Yet, formalization is both informational and organizational. Approaching formalization as an organizational accomplishment brings people back into the discussion of systems and shows the salience of social status and institutional recognition. Unlike other networks, assemblages, or articulations, infrastructures are necessarily purposive, a form of ‘calculative reason’ that ‘promises to collect a heterogeneous, changing group of elements “beneath” some higher-order goal’ (Carse 2017, pp. 35–36). This is not to say that goals do not shift and overlap, but rather that infrastructures are not accidental accomplishments; they involve the systematic organization of people in service of a rationale. As such, infrastructures are partisan, prescribing roles and allocating benefits. Formalization can also involve the status of infrastructures. That formalization is also a matter of legitimation is evident in the controversies around the building of walls along national borders or the lack of recognition granted to informal infrastructures like homeless encampments (Gordon and Byron, this issue). Understanding the politics of formalization thus involves interrogating the forms built into a system (informational foundation), the roles formalized by a system (who is this for?), and processes of legitimation surrounding systems (formal recognition).

Imaginary

The imaginary – whether qualified as social, technological, socio-technical, or infrastructural – straddles the descriptive and normative, the what and the

why. The concept refers to various 'ways of thinking about what infrastructures are, where they are located, who controls them, and what they do' (Parks 2014), always with an eye towards the future (Markham 2020). If the practice of infrastructure is meant to go unnoticed, its promise is often highly prominent, taking the form of political discourse and advertising campaigns, feasibility studies, and data visualizations. As Appel, Annand, and Gupta observe, material infrastructures 'have long promised modernity, development, progress, and freedom to people all over the world' (2018, p. 3). These ways of thinking shape how people relate to infrastructural projects, enrolling support, mobilizing opposition, motivating maintenance, and so on. At the same time, actual conditions of infrastructures threaten breakdowns and failures, and infrastructural decay counters narratives of technological progress. Tensions between promise, practice, and persistence are constitutive features of infrastructural imaginaries because the imagination does not exist in isolation, elevated from the material world. On the contrary, Nielsen and Pedersen argue that 'imagination does not always operate and move from the subject outwards but also from the world inwards' (2015, p. 239). That is, imagination encompasses both intentional creativity and empirical conditions. Consequently, infrastructural imaginaries are potent sites of political intervention where people construct and contest narratives about the purpose of particular projects.

For critical or abolitionist projects, the imagination of infrastructure is an essential concern, the means through which different connections or even different worlds become possible. Which is not to say that transforming infrastructural imaginaries is an easy task, as prominent patterns of understanding often become so through 'immense institutional force' (Gaonkar 2002, p. 4). Drawing on ethnographic experience with arts-based interventions, Annette Markham argues that 'people seem to have difficulty imagining futures in ways that do *not* reproduce current ideological trends or cede control and power to external, mostly corporate, stakeholders' (2020, p. 3). Projections of inevitability position people as powerless and close off alternative imaginaries, establishing the importance of a critical pedagogy that can provide 'radical scaffolding for people to imagine otherwise' (*ibid*). In an essential edited collection on race, technology, and the liberatory imaginary, Ruja Benjamin makes a similar appeal, calling for a 'far-reaching *sociotechnical imaginary* that examines not only how the technical *and* social components of design are intertwined, but also imagines how they might be configured differently' (2019, p. 5). The project of imagining otherwise involves tracing the processes through which alternatives are rendered invisible or secret, proposing new configurations of people and systems, and 'telling better stories' (Wood 2019). Even, or especially, when dealing with the imposing materiality of large-scale systems, the concept of imaginary offers a reminder of the

continued importance of representation, ideology, and the cultural production of meaning.

The map of the issue

The previous section presented three concepts – scale, formalization, and imaginary – which deepen and explicate the political questions and commitments of this special issue. In this final section, we formally introduce the articles of the issue and its organizing structure based on the preceding concepts. Across the essays, readers will encounter a rich range of case studies, analytic approaches, and interdisciplinary inquiry each theorizing infrastructural politics.

Section 1: scaling problems and solutions

The first section brings together essays about the digital supply chain, data centres, social media, artificial islands, and podcast discovery platforms, each acutely attuned to the articulation of relationships – often overlooked or unexpected – across time and space. Whether understood as a ‘figurative force’ (Hallinan), a set of ‘chains’ (Hockenberry), or an ‘infrastructural imposition’ (Velkova), infrastructures establish connections that fit poorly with established divisions – industrial, political, and geographic. In tracing these complex configurations of control, the papers in this section highlight the importance of scale to the promise, and subsequent problems, of infrastructure, while developing new ways of conceptualizing, caring about, and changing that which underlies culture as a collection of artifacts and a way of life.

Opening the issue is an essay about obfuscated attachments, an idea best demonstrated by way of example. The political inheritances of slavery, empire, and militarization seemingly have nothing to do with Seat.io, a company that provides online ticketing technology, although the domain name – formally tied to the British Indian Ocean Territories – tells a different story that traces back to a group of slaves infected with leprosy that was abandoned on the Chagos archipelago at the end of the eighteenth century. These sorts of articulations are the subject of Matthew Hockenberry’s paper ‘Redirected Entanglements in the Digital Supply Chain’. Data, Hockenberry argues, is never raw and is always assembled at cost, even as such costs are increasingly difficult to audit. Moving from data containers to conflict domains, the digital supply chain promises an abstracted mechanism of control that remains meaningfully, and at times devastatingly, material. The illusion of automation and unrestricted access depends on a global, casualized workforce, reflected in the figure of the content moderator and the contracted labourer. Algorithmic systems also depend on the computational capture of human subjects, perhaps most evident in racialized classifications

powered by biometric data. The paper provides a powerful way of thinking about the connections, or better, *the chains* organizing our current conjuncture.

We then move from the metaphor of the supply chain to the muddled materiality of a new source of 'clean' energy. The mantra 'data is the new oil' initially referred to the value of user data within the platform economy, driving advertisements, personalized recommendations, and logistical operations. In 'Thermopolitics of Data: Cloud Infrastructures and Energy Futures', Julia Velkova investigates an alternative set of associations more directly tied to energy politics – namely, the transformation of data centres into thermal urban infrastructure. In 2016, the Russian platform Yandex built a data centre in Mäntsälä, Finland, since the company's computing needs were growing and the town offered an appealing solution with its cooler temperatures and existing transportation infrastructure. Through the lens of thermopolitics, Velkova shows how the data centre continues to rely on coal and nuclear energy even as the city claims to be decarbonized by redistributing the centre's heat into local homes. Velkova also demonstrates how the articulation of the platform economy, with its fast cycles of development and obsolescence, introduces temporal instability to the infrastructural provision of energy. The paper raises difficult ethical and regulatory questions about the infrastructural imposition of relationships across national borders that takes place with little public awareness, let alone deliberation or choice.

The next essay engages with infrastructures designed to attract attention. In "'The World is Sinking': Sand, Urban Infrastructure, and World-Cities', Burç Köstem turns to the city of Dubai, with its monumental glass towers, artificial islands, and colossal shipping ports – projects of 'infrastructural exuberance' – to answer the question of how sand, one of the most abundant materials on earth, has become scarce to the point of provoking both international concern and international conflict. The paper traces a cyclical history of urbanization in Dubai, where each act of dredging sand eventually becomes a source of scarcity that necessitates further dredging, culminating in the crisis-ridden and ongoing construction of the World Islands. Although Dubai's use of sand is particularly spectacular, the city is not alone in the problems of spectacularized production. As Köstem shows through a comparative analysis of Singapore, Mumbai, and Istanbul, geosocial ties cross conventional geopolitical boundaries. Scarcity is thus a particular set of relations produced by both 'sedimental and sentimental' flows rather than a natural fact, and the paper concludes with a call for an ethics of collective abundance that seeks the redistribution of resources in the service of urban and planetary justice.

Continuing the concern with sentiment, the next essay turns from sand and geosocial relations to sharing and social media. Platform policy

documents like Terms of Service and Community Guidelines are not exactly etiquette guides, although they share the purpose of delimiting proper conduct and proper people. This is the opening conceit of Blake Hallinan's 'Civilizing Infrastructure', which adapts sociologist Norbert Elias's ([1939] 2000) conceptualization of the civilizing process to examine social media platforms as a 'figurative force' that has scaled *up* in terms of the number of people entangled, and scaled *out* in terms of integration into public life. Taking seriously Facebook's ambition to become *the* social infrastructure of the world, Hallinan analyzes the pedagogical, punitive, and productive practices through which the platform sanctions particular subjects and modes of behaviour. From the company's corporate vision and expansionist history, to policies and moderation practices, to channelled interactions and incentive structures, Facebook constructs both social norms and societal ideals tied to a transnational corporation rather than a nation state. Through its ability to sense and actively shape human connection and communication, Facebook's infrastructure acts as both object and agent of civilization, a development that has begun to move beyond social media platforms and into the built environment.

For digital platforms, scale is both a source of problems and the promised solution for successfully monetizing attention. In 'Infrastructures of Discovery: Examining Podcast Ratings and Rankings', Jeremy Morris traces the industrialization of podcasting, where platforms play an increasingly important role in the growth and monetization of audiences. Ratings, charts, and recommendations constitute an infrastructure of discovery designed to address the twinned problems of discoverability, understood as the way to convert and cultivate listeners, and measurability, or the means through which to market those listeners to advertisers. Through an analysis of chart controversies, platform interfaces, and industry lore, Morris argues that platforms provide a hinge between cultural consumption and production, shaping the presentation of content to potential listeners and the optimization of content for discoverability. Ubiquitous calls to rate, review, and subscribe persist despite little evidence of their effectiveness, reflecting the precarious position of podcasters. In seeking the expansion and economic valuation of the podcasting industry, platformization places technical problems at the heart of cultural production, affecting the practice of podcasting and the people best positioned to pursue it.

Section 2: working for, against, and alongside formalization

The second section brings together essays about audio engineers, recommendation system developers, emergency dispatchers, digital platform laborers, the subjects photographed for facial recognition datasets, and government employees, each providing a compelling vantage point through

which to investigate the processes of formalization endemic to the operation of infrastructure. Nick Seaver's apt phrase 'seeing like an infrastructure' captures a common concern with the ways that systems represent and realize particular aspects of the world, although the various contributors might expand the phrasing to include listening (Sterne and Razlogova), managing (Ferrari and Graham), literally seeing (Stevens and Keyes), and maintaining (Ellcessor; Gordon and Byron). As the essays attest, formalization is neither inherently oppressive nor liberatory, but it is always power-laden especially when entrenched in and through infrastructures.

The first paper begins with a pronouncement: artificial Intelligence is coming, at least according to major tech corporations, commentators, and the field of computer science. In 'Tuning Sound for Infrastructures: Artificial Intelligence, Automation, and the Cultural Politics of Audio Mastering', Jonathan Sterne and Elena Razlogova use LANDR, an automated music mastering application branded as artificially intelligent, as a case study through which to ask how this situation – both the platform and the broader narrative of AI's inevitability – became possible. Sterne and Razlogova uncover a complex and overlapping set of necessary conditions, involving available data, the institutional position of music mastering, the standardization of audio profiles, and the development of machine learning techniques. The history of LANDR and the pivot from audio mixing to music mastering as a more manageable challenge for machine learning is indicative of the challenges involved in rendering culture commensurable. In place of inevitability, the paper presents substantial infrastructural operations that reframe the 'aesthetic practices and cultural values' of all aspects of cultural production – audio, visual, and otherwise.

Where Sterne and Razlogova examined the conditions necessary for the emergence of automated music mastering, Nick Seaver's essay 'Seeing Like an Infrastructure: Avidity and Difference in Algorithmic Recommendation' shifts the focus from production to distribution of cultural goods. The answer to the question of what your favourite music says about you depends, as Seaver shows, on who – or what – is responding. The developers of music recommendation systems understand listeners not through conventional scenes or genre preferences, nor demographic categories, but on the basis of avidity, enthusiasm for music measured through clicks. As a particular way of making sense of the differences between 'lean-in' developers and predominantly 'lean-back' users, avidity provides a way of designing for difference that simultaneously seeks to eradicate it, using recommendations to cultivate more avid users and thus more data. The essay makes a strong case for seeing like an infrastructure, or examining the mental models of the people who build and rebuild algorithmic systems, to study how infrastructures shape the world.

If developers occupy a privileged position for understanding socio-technical systems, they are by no means the only ones. In 'The Care and Feeding of 9-1-1 Infrastructure: Dispatcher Culture as Media Work and Infrastructural Transformation', Elizabeth Ellcessor studies the role of emergency dispatchers in shaping the meaning of 'emergency' and the management of emergency response. As the North American telecommunication system for public services, including hospitals and the police, 9-1-1 is a logistical infrastructure that dispatchers both manage and maintain. However, Ellcessor shows that the position requires more than infrastructural maintenance; it is also a form of media work, involving the interpretation of media content and the navigation of media systems. Challenging the institutional classifications of dispatch as a form of customer service, outside the proper domain of emergency services, Ellcessor shows the centrality of dispatch, or better, dispatchers as media professionals, to producing emergency response. In addition to the implications for the status of dispatchers, including access to the employment benefits associated with emergency services, the paper also forwards an understanding of media work that moves beyond the production of individual texts towards the taken-for-granted and highly-mediated systems that support contemporary life.

Continuing the issue's concern with the organization of labour, Fabian Ferrari and Mark Graham focus on digital labour platforms, which include geographically tethered forms of work such as driving people or making deliveries, and cloud work that can ostensibly be conducted anywhere in the world. Their paper, 'Fissures in Algorithmic Power: Platforms, Code, and Contestation', investigates how people creatively work alongside and against algorithmic forms of management. Beginning with the premise that algorithmic management, like any form of employee management, is necessarily partial, the paper presents a typology of worker tactics, each with different opportunities and risks. Manipulation involves the direct circumvention of power, breaking the rules of the platform through third-party software, multiple accounts, and so on in service of better assignments or compensation. Subversion entails following the rules creatively, honouring the letter of the law but not the spirit, and disruption refers to the creation of 'digital picket lines' that disrupt the operation of platforms. While these counteractions challenge the asymmetrical power relations between platform and worker, they offer no guarantee of autonomy. Instead, the idea of fissures highlights the analytical importance of moving beyond algorithmic hegemony in our modes of analysis as we work towards new forms of accountability.

While Ferrari and Graham find reason for qualified optimism concerning the plight of the worker on digital labour platforms, the next paper adopts an oppositional stance towards the formalization of human subjects in the case of facial recognition technologies. In 'Seeing Infrastructure: Race,

Facial Recognition, and the Politics of Data', Nikki Stevens and Os Keyes present a critical history of facial recognition datasets, reconstructed from documents retrieved through the United States Freedom of Information Act. Starting with a set of photos from CIA-funded research in 1963 and ending with the 2019 Diversity in Faces dataset from IBM, they find that 'biases' of datasets reflect their use in specific contexts. Datasets designed for government applications in security and policing tend to overrepresent African Americans, while datasets for corporate applications in targeted advertising tend to underrepresent, at least compared to the general population. Contra calls for fairness through greater representation, Stevens and Keyes reject the framing of harm as an accidental outcome. Seeing infrastructure, or the broader set of facial recognition technologies used in surveillance and security, is inextricably bound up in the control of Black and brown bodies, not only in its context of use but in its installed base of image datasets.

The final essay in this section establishes that formalization can be both a technological matter and an organizational accomplishment, reflected in institutional recognition, state sanction, and other markers of status. Formal infrastructures come with a measure of protection and belonging denied to their informal counterparts, a point well demonstrated by the analysis of homeless encampments in Constance Gordon and Kyle Byron's 'Sweeping the City: Infrastructure, Informality, and the Politics of Maintenance'. Encampments offer a precarious alternative to the failures of formal housing. However, this alternative is made even more tenuous by the ever-present threat of sweeps, or state efforts at removing encampments that address the visibility of informal infrastructures and ignore the conditions that create homelessness. For urban infrastructure, formality is neither an intrinsic quality nor a consequence of function, but rather a political designation produced through laws, acts of maintenance conducted by municipal departments, and public participation. The paper conceptualizes maintenance as an everyday form of politics and follows challenges over classification taking place on the streets in two cities: San Francisco, United States and Toronto, Canada. Gordon and Byron show the importance of asking questions about maintenance, including 'what is being maintained, for whom, and toward what end', and provide an exemplary model for how to do so.

Section 3: analyzing imaginaries, imagining interventions

The third section brings together essays about infrastructural imaginaries, or the particular ways of understanding the purpose and possibilities of infrastructure that manifest through a multitude of forms, including model homes, local tourism initiatives, land surveys, political demonstrations, public databases, and the promises of politicians. Whether an object of

analysis (Woods; Scott), a site of contestation (Omer; Monahan), or an impetus for action (Poirier; Reynolds), infrastructural imaginaries shape the social significance of systems, demonstrating their importance for understanding both the politics enacted through infrastructure and the opportunities for political response. Infrastructural control may take the form of the serpent's coils, but these essays show how the serpent's path is shaped in no small part by what people imagine an infrastructure is – and *should be*.

The first essay begins at home, or rather, at the model smart homes of residential communities in the suburbs of Washington, DC. In 'Smart Homes: Domestic Futurity as Infrastructure', Heather S. Woods analyzes the infrastructural imaginary expressed in a set of brochures, tours, promotional signage, and home design. Domestic futurity, Woods explains, is an idea of the home mediated by 'platforms, technological products, and informational logics', traditional in its exterior design and ideological appeal yet transitional in the integration of corporate partnerships and platform labour. The paper focuses on two of the 'smartest' features of the smart home: the drop zone and the landing pad. The former refers to a small room off the side entrance of the house, secured from the main home, where packages can be stored and groceries delivered, including even a separate refrigerator to keep everything cool. The Landing Pad refers to an exterior site for drone-based deliveries, indicative of an animating vision where people are no longer required at the last leg of logistics. Together, the features of the model home also model an idea of society where domestic futurity brings pleasure and protection for privileged homeowners and risks for the laborers designed to interface with the house, physically removed from its inhabitants and subject to surveillance.

The next essay moves from the home to the hometown, extending the exploration of the relationship between a nostalgic past and a technological future. In "'We Don't Even Know Who Owns It": The Infrastructural Imaginary of Spruce Pine, NC', D. Travers Scott investigates the visibility, publicity, and politics of a small mining town in the Southern United States. Although Spruce Pine is one of the most prominent sites for the production of high-quality quartz, an essential component of electronics manufacture, the town's role in the high-tech industry remains an open secret, simultaneously acknowledged and obfuscated. Through city slogans, signs, festivals, tours, and local media publications, Scott analyzes the processes through which Spruce Pine disarticulates from the tech industry. The process is both industrial and ideological, as conservative populism is a prominent part of the town's identity, aligned with the promotional figure of the old-timey prospector looking to strike it big in the mines. The paper challenges our understanding of what 'high tech' means (as industry, infrastructure, and identity), while demonstrating the value of walking around as a method to study the stories and sense-making of a place.

Walking can also be a means of political mobilization as in the protest march across Pakistan's Thar Desert analyzed in the next essay. In 'Coal Ground', Ayesha Omer investigates the ground itself as a 'political substrate' of global infrastructural networks, rather than as a static prior condition. As a site of China's coal energy infrastructure network, open pit coal mines and thermal power plants promise modernity and prosperity, an imaginary constructed through decades of tests, drillings, surveys, and data analyses that define the land exclusively in relation to petroleum resources. Such promises are further promoted by national and international marketing initiatives, yet the ethical framing fits poorly with flooded waste water and poisoned wells. Facing future promises predicated on present life-threatening harms, Indigenous Tharis have fought back against the extractive coal data imaginary, highlighting the cultural and political conditions surrounding access to and use of water through protest marches, protracted hunger strikes, and newspaper sit-ins. As Omer's research attests, infrastructural imaginaries encompass not only built systems but also the very ground on which systems are built.

Contestation over the meaning of a space is certainly not exclusive to the Thar Desert, even as the stories and tactics take on different forms in different contexts. Following the question of what happens when platforms meet the physical environment, Torin Monahan investigates disputes over the meaning and values of short-term rental platforms in different cities across the United States. Short-term rental platforms, with Airbnb the most notable example, are part of the platformization of infrastructure, an orientation towards the city and its services that tends to privilege the market over rights. Drawing on interviews with informants in San Francisco, CA, Boston, MA, and Austin, TX, Monahan presents two competing infrastructural imaginaries, one associated with advocates and the other with community opposition. For the former, short-term rental platforms facilitate interactions among strangers with immediate interpersonal benefits and potential political transformations up to and including world peace. The latter position articulates such platforms with the problems of gentrification, displacement, racial inequality, and the casualization of labour, driving community organizing in the service of increased regulations. In contested imaginaries, the politics and power relations of infrastructures come to the fore, offering an opportunity for understanding and grounds on which to problematize platforms.

Where the previous two papers chronicled the clash of mutually exclusive modes of understanding, the next essay charts an alternative path between the promises and perils of infrastructure. In 'Data(-)based Ambivalence Regarding NYC 311 Data Infrastructure', Lindsay Poirier analyzes how citizens, activists, and policy-makers in New York City engage with the city's infrastructure for reporting quality of life concerns. Initially founded to reduce the load

of emergency dispatch, 311 acts as a centralized point for requesting city services that publishes each request and response on the NYC open data portal. The resulting database promises ‘real-time, crowd-sourced evidence of problems facing New Yorkers’. Despite the democratic valence, the system purposefully makes it difficult to determine the source of reports, rejects reports related to public housing, and is influenced by public campaigns that encourage people to report specific issues such as homelessness. Activists and politicians often recognize the limits of representation even as they find the reports useful for legitimizing claims about community problems, resulting in a disposition towards data infrastructure that Poierer names ‘data(-)based ambivalence’. Neither fully committed to the objectivity of data nor skeptical of its underlying utility, a data(-)based ambivalent approach treats data as a rhetorical tool to achieve political goals.

If ambivalence offers an effective stance for those external to infrastructure, mischief marks out internal operations capable of countermanding a system’s stated goals. In ‘Mischievous Infrastructure: Tactical Secrecy Through Infrastructural Friction in Police Video Systems’, CJ Reynolds contrasts the promise of body cameras as tools of transparency and accountability with the continued, even growing, lack of trust between the public and police in the United States. Understanding the gap between promise and practice, Reynolds argues, requires conceptualizing body cameras not as discrete technologies but rather as part of a larger policing infrastructure that renders videos captive, their release contingent on the cooperation of police. For officers and administrators, mischief largely takes the form of infrastructural friction: a camera turned off, footage forgotten or mistagged, extensive redactions, strict requirements on the site of viewing, and so on. These actions perpetuate opacity and transform transparency into a matter of strategic disclosure rather than public accountability. Although particularly evident in police video systems, all infrastructures mediate multiple stakeholders and where there is antagonism, there is likely to be mischief. The paper concludes with a cautionary reminder of the public pressure necessary to make it out of the ‘mire of mischief’ and realize the promise of infrastructure, a message that cuts across contexts and, indeed, this volume as a whole.

Concluding remarks

Making a case for technological determinism, long avoided as an ‘intellectual misdemeanor’ and wielded as an academic weapon to dismiss the work of others, John Durham Peters argues that ‘We can’t afford to not try to tell big stories about data power or infrastructural shape’ (2017, p. 13, 24). This special issue, stretched over an introduction and seventeen essays, might best be positioned as a *big story* about infrastructural politics in the present conjuncture, one effort among many to map how infrastructures

help establish, and perhaps even determine, patterns of cultural life. Despite our embrace of the determinism mantle, it is important to note that infrastructural politics are never as orderly as infrastructures themselves promise to be. Returning to Deleuze's metaphor, we would argue that coils of control cannot be explained by a single serpent, and their constrictions, while pressingly real, are not totalizing. From fissures in algorithmic power created by worker organizing (Ferrari and Graham), to mischievous actions undermining the stated purpose of a system (Reynolds), to the acts of care that shape and sustain communication networks (Elcessor), our contributors demonstrate that infrastructural determination is produced and negotiated rather than pre-determined. Yet the scale of such productions, crossing borders and involving potentially billions of people, creates unexpected entanglements (Hockenberry) that defy conventional approaches to regulation (Velkova) and contribute to the identity and influence of corporations as geopolitical actors (Hallinan). Telling bigger, better stories about the relationship between infrastructure and culture is a complicated endeavour, and we hope you find the following essays instructive examples. May your own engagements with infrastructure produce safe travels, enriching connections, and equitable distributions.

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References

- Anand, N., Gupta, A. and Appel, H., eds., 2018. *The promise of infrastructure*. Durham, NC: Duke University Press.
- Aouragh, M. and Chakravarty, P., 2016. Infrastructures of empire: towards a critical geopolitics of media and information studies. *Media, culture & society*, 38 (4), 559–575.
- Batt, W.H., 1984. Infrastructure: etymology and import. *Journal of professional issues in engineering*, 110 (1), 1–6.
- Beniger, J.R., 1986. *Technological and economic origins of the information society*. Cambridge: Harvard University Press.
- Benjamin, R., 2019. *Captivating technology: race, carceral technoscience, and liberatory imagination in everyday life*. Durham: Duke University Press.
- Bowker, G.C. and Star, S.L., 2000. *Sorting things out: classification and its consequences*. Cambridge, MA: MIT Press.
- Bowker, G.C., et al., 2009. Toward information infrastructure studies: ways of knowing in a networked environment. In: J. Hunsinger, L. Klastrup and M. Allen, eds. *International handbook of internet research*. Dordrecht: Springer Netherlands, 97–117.
- Bratslavsky, L., Carpenter, N., and Zompetti, J., 2020. Twitter, incivility, and presidential communication: a theoretical incursion into spectacle and power. *Cultural studies*, 34 (4), 593–624.
- Bridge, G., Özkaynak, B., and Turhan, E., 2018. Energy infrastructure and the fate of the nation: introduction to special issue. *Energy research & social science*, 41, 1–11.
- Carey, J.W., 1992. *Communication as culture: essays on media and society*. New York: Routledge.
- Carse, A., 2017. Keyword: infrastructure. How a humble French engineering term shaped the modern world. In: P. Harvey, C.B. Jensen and A. Morita, eds. *Infrastructures and social complexity: a companion*. New York, NY: Routledge, 27–39.
- Coleman, R., 2018. Theorizing the present: digital media, pre-emergence and infrastructures of feeling. *Cultural studies*, 32 (4), 600–622.
- Deleuze, G., 1992. Postscript on the societies of control. *October*, 59, 3–7.
- du Gay, P., et al., 2013. *Doing cultural studies: the story of the Sony Walkman*. Thousand Oaks, CA: Sage Publications.
- Edwards, P., et al., 2009. Introduction: an agenda for infrastructure studies. *Journal of the association for information systems*, 10 (5), 364–374.
- Elias, N., 2000. *The civilizing process: sociogenetic and psychogenetic investigations*. Rev. ed. Oxford: Blackwell Publishers.
- Ensmenger, N., 2018. The environmental history of computing. *Technology and culture*, 59 (4S), S7–S33.
- Galloway, A.R., 2004. *Protocol: how control exists after decentralization*. Cambridge, MA: MIT Press.
- Gaonkar, D.P., 2002. Toward new imaginaries: an introduction. *Public culture*, 14 (1), 1–19.
- Gilmore, J.N., 2017. From ticks and tocks to budes and nudges: the smartwatch and the haptics of informatic culture. *Television & new media*, 18 (3), 189–202.
- Gilmore, J.N. and Troutman, B., 2020. Articulating infrastructure to water: agri-culture and Google's South Carolina data center. *International journal of cultural studies*, 23 (6), 916–931.
- Graham, S., 2010. When infrastructures fail. In: S. Graham, ed. *Disrupted cities: when infrastructure fails*. New York: Routledge, 1–26.

- Graham, S. and Marvin, S., 2001. *Splintering urbanism: networked infrastructures, technological mobilities and the urban condition*. London: Routledge.
- Grossberg, L., 2019. Cultural studies in search of a method, or looking for conjunctural analysis. *New formations*, 96 (96), 38–68.
- Grossberg, L. and Slack, J.D., 2016. Editor's introduction. In: J.D. Slack and L. Grossberg, eds. *Cultural studies 1983: a theoretical history*. Durham, NC: Duke University Press, vii–xiv.
- Hall, S., 2001. Encoding/decoding. In: M.G. Durham and D.M. Kellner, eds. *Media and cultural studies: keywords*. Malden, MA: Blackwell Publishing, 163–173.
- Hallinan, B. and Striplas, T., 2016. Recommended for you: The Netflix prize and the production of algorithmic culture. *New media & society*, 18 (1), 117–137.
- Harvey, P., Jensen, C.B., and Morita, A., 2017. Introduction: infrastructural complications. In: P. Harvey, C. B. Jensen, and A. Morita, eds. *Infrastructures and social complexity: a companion*. New York: Routledge, 1–22.
- Hay, J., 2004. Toward a spatial materialism of the “moving image”: locating screen media within changing regimes of transport. *Cinéma and cie*, 5, 43–51.
- Highmore, B., 2002. Introduction: questioning everyday life. In: B. Highmore, ed. *The everyday life reader*. New York: Routledge, 1–36.
- Hughes, T.P., 1987. The evolution of large technological systems. In: W.E. Bijker, T.P. Hughes and T. Pinch, eds. *The social construction of technological systems*. Cambridge, MA: MIT Press, 45–76.
- Iddins, A., 2020. The digital carceral: media infrastructure, digital cultures and state surveillance in post-Arab Spring Morocco. *International Journal of Cultural studies*, 23 (2), 245–263.
- Jackson, S., 2014. Rethinking repair. In: T. Gillespie, P.J. Boczkowski and K. Foot, eds. *Media technologies: essay on communication, materiality and society*. Cambridge, MA: MIT Press, 221–240.
- Jackson, S.J., et al., 2007. Understanding infrastructure: history, heuristics and cyberinfrastructure policy. *First Monday*, 12 (6).
- Larkin, B., 2013. The politics and poetics of infrastructure. *Annual review of anthropology*, 42 (1), 327–343.
- Markham, A., 2020. The limits of the imaginary: challenges to intervening in future speculations of memory, data, and algorithms. *New media & society*, 1–24.
- Miles, C., 2019. The combine will tell the truth: On precision agriculture and algorithmic rationality. *Big data & society*, 6 (1), 205395171984944.
- Mohan, S. and Punathambekar, A., 2019. Localizing YouTube: language, cultural regions, and digital platforms. *International journal of cultural studies*, 22 (3), 317–333.
- Nielsen, M. and Pedersen, M.A., 2015. Infrastructural imaginaries: collapsed futures in Mozambique and Mongolia. In: M. Harris and N. Rapport, eds. *Reflections on imagination: human capacity and ethnographic method*. New York: Routledge, 237–262.
- Ogie, R.I., Perez, P., and Dignum, V., 2017. Smart infrastructure: an emerging frontier for multidisciplinary research. *Proceedings of the institution of civil engineers - smart infrastructure and construction*, 170 (1), 8–16.
- Packer, J., 2008. *Mobility without mayhem: cars, safety, and citizenship*. Durham: Duke University Press.
- Parks, L., 2005. *Cultures in orbit: satellites and the tele-visual*. Durham: Duke University Press.
- Parks, L., 2014. Media infrastructures and affect. *Flow*. Available from: <https://www.flowjournal.org/2014/05/media-infrastructures-and-affect/>

- Parks, L. and Starosielski, N., 2005. *Signal traffic: critical studies of media infrastructures*. Champaign, IL: University of Illinois Press.
- Peters, J.D., 1988. Information: notes toward a critical history. *Journal of communication inquiry*, 12 (2), 9–23.
- Peters, J.D., 2013. Calendar, clock, tower. In: J. Stolow, ed. *Deus in machina: religion, technology, and things in between*. New York: Fordham University Press, 25–42.
- Peters, J.D., 2015. *The marvelous clouds: towards a philosophy of elemental media*. Chicago, IL: University of Chicago Press.
- Peters, J.D., 2017. “You mean my whole fallacy is wrong”: On technological determinism. *Representations*, 140 (1), 10–26.
- Plantin, J.-C., et al., 2018. Infrastructure studies meet platform studies in the age of Google and Facebook. *New media & society*, 20 (1), 293–310.
- Plantin, J.-C. and Punathambekar, A., 2019. Digital media infrastructures: pipes, platforms, and politics. *Media, culture & society*, 41 (2), 163–174.
- Rodgers, D., and O’Neill, B., 2012. Infrastructural violence: introduction to the special issue. *Ethnography*, 13 (4), 401–412. <https://doi.org/10.1177/1466138111435738>
- Seaver, N., 2017. Algorithms as culture: some tactics for the ethnography of algorithmic systems. *Big data & society*, 4, 2.
- Sharma, S., 2014. *In the meantime: temporality and cultural politics*. Durham, NC: Duke University Press.
- Slack, J.D., 1996. The theory and method of articulation in Cultural studies. In: D. Morley and K.-H. Chen, eds. *Stuart Hall: critical dialogues in cultural studies*. New York: Routledge, 113–130.
- Star, S.L., 1999. The ethnography of infrastructure. *American behavioral scientist*, 43 (3), 377–391.
- Star, S.L. and Ruhleder, K., 1996. Steps toward an ecology of infrastructure: design and access for large information spaces. *Information systems research*, 7 (1), 111–134.
- Sterne, J., 2012. *MP3: the meaning of a format*. Durham: Duke University Press.
- Striphas, T., 2019. Caring for cultural studies. *Cultural studies*, 33 (1), 1–18.
- Suchman, L.A., 1987. *Plans and situated actions: the problem of human-machine communication*. Cambridge: Cambridge Univ. Press.
- Williams, R., 1958. *Culture and society*. London, UK: Hogarth.
- Williams, R., 1977. *Marxism and literature*. New York, NY: Oxford University Press.
- Wise, J.M., 1998. Intelligent agency. *Cultural studies*, 12 (3), 410–428.
- Wood, M.M., 2019. On ‘telling better stories’. *Cultural studies*, 33 (1), 19–28.
- Woolgar, S., 1991. The turn to technology in social studies of science. *Science, technology, & human values*, 16 (1), 20–50.