

THE ROUTLEDGE COMPANION TO MEDIA INDUSTRIES

Edited by Paul McDonald

First published 2022

ISBN: 978-0-367-22526-1 (hbk)

ISBN: 978-1-032-06534-2 (pbk)

ISBN: 978-0-429-27534-0 (ebk)

10

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DOI: 10.4324/9780429275340-13

The funder is University of Leeds.

 **Routledge**
Taylor & Francis Group
LONDON AND NEW YORK

10

THE INFRASTRUCTURAL TURN IN MEDIA AND INTERNET RESEARCH¹

David Hesmondhalgh

In recent years, media studies (including “screen studies” and television studies, among other sub-fields) and internet studies have paid increasing attention to the concept of *infrastructure*, and to the related concept of *distribution*. In everyday usage, the term infrastructure refers to “the basic systems and services that are necessary for a country or an organization to run smoothly, for example buildings, transport and water and power supplies” (*Oxford English Dictionary*, n.d.). There could hardly be a more timely concept in an era where the COVID-19 pandemic has made clear how dependent more or less everyone is on such systems and services. As we shall see, however, the term has come to be used in a diffuse range of ways in media and internet research.

Interest in infrastructure within media and internet studies has often built upon earlier research on infrastructures in social science and humanities, especially sociology of science and technology, anthropology, and geography (see Larkin 2013 for a fine survey that covers these fields). The recent revival of distribution as a key concept in media studies is closely related to the growth of interest in infrastructure, and the growing concern with both concepts can ultimately be attributed to the challenges to existing models of communication thrown up by the internet and the web from the 1990s onward.

In this chapter, I discuss some of the benefits for media and internet research generated by the “infrastructural turn” and the associated turn to distribution. These advantages include a welcome concern with the mundanity and ordinariness of existing systems rather than optimistic speculation about future impacts, and an invigorating interest in questions of representation and meaning in relation to often taken-for-granted technologies. But when terms and concepts become fashionable in academia, problems often arise, and so I also want to discuss some of the problems surrounding these turns: a tendency in media and internet studies to use the term “infrastructure” in such a variety of ways that the term risks losing its analytical value; an uncertain engagement with ideas of materiality and “relationality”; and a tendency toward banality and vagueness (including dubious defenses of vagueness itself). I close by reflecting on how the problems identified seem to have led to a neglect of other traditions of research, such as political economy of media, that might provide insights into the workings of media infrastructures as traditionally understood, but in a call for synthesis, I also point to how those other traditions have often failed to pay due attention to the best contributions of recent media infrastructural studies.

Studies of media and information infrastructures: Development and contributions

Underlying a great deal of recent work on media infrastructures has been a desire to puncture inflated and generalized claims about networked information systems by emphasizing the *mundane* combinations of technological and social factors that allow such systems to function. Many discussions of infrastructure in media and internet studies refer to the work of the sociologist Susan Leigh Star. In a much-cited piece on “The Ethnography of Infrastructure”, Star (1999) pointed to the potential benefits of studying the most ordinary, everyday aspects of the information systems that, at the time she was writing, were emerging from the commercialization of digital networks. “Information infrastructure” had become a popular term in public and media debate about the future of computing in the 1990s, as policymakers pondered the construction of a new “national information infrastructure.” Seeking to challenge technicist understandings of infrastructure in such debates, Star and her collaborators provocatively used the term to refer as much to social and organizational factors, most notably classifications and standards (Bowker and Star 1999), as to technical, material ones. In doing so, Star borrowed from her colleague and husband Geoffrey Bowker, another sociologist of science and technology, who had previously called for what he termed *infrastructural inversion* (Bowker 1994: 10), importing a metaphor from psychology to argue that “ground” or background infrastructural elements should be treated as “figure” or foreground. Picking up on this, Star (1999: 377) advocated the study of “boring things,” such as wires, settings, and engineering standards. The version of media and information infrastructural studies propagated by Star, Bowker, and others in the 1990s and 2000s, focused on mundanity, helped to counter prevalent discourses, which saw the internet as imbued with rebellion and adventure (Streeter 2011: 119–137).

Star and her colleagues, in other words, sought to de-romanticize and demystify information, and the focus on the ordinary and taken-for-granted in studies of “information infrastructures” was to prove appealing to many social science and humanities researchers. The most eloquent advocate of such boringness has been the communication scholar John Durham Peters, for whom a focus on infrastructures helps counter a habit, shared by academics and many others, of “isolating the bright, shiny, new or scary parts of our made environment and calling them ‘technology’ to the neglect of the older, seemingly duller parts” (2015: 36). In this respect, infrastructural studies fit with a long-standing desire in media and cultural studies to question what is taken for granted, and to make obscured processes, systems, and values more visible.

Infrastructural studies, in the mode shaped by Star, Bowker and others, was one of a number of strands of social science research, especially in sociology, that paid close attention to the social and cultural factors influencing the form and use of technologies in ways that challenged mainstream understandings of technology within science, engineering and public policy. There was a body of research that, from the 1980s onward, had focused on “the social construction of technical systems” (Bijker, Hughes, and Pinch 1987) or the “social shaping of technology” (MacKenzie and Wajzman 1999), challenging science, engineering and public policy’s often excessive focus on the agency of technology itself. Sometimes intersecting with these strands, though in some ways at odds with it, was actor network theory (ANT), focused (at least initially, before it expanded into other domains) on how scientific and technological knowledge was produced out of relations and associations between “actors,” used in a very particular way to refer to objects and practices, as much as humans (Michael 2017). A term widely used for these sociologically oriented ways of studying science and technology, often focused on their most mundane aspects, is science and technology studies (STS). Very little STS research had paid attention to the concept of infrastructure until Star, Bowker, and their associates published

their influential research, so the information infrastructuralists deserve credit for expanding the range of STS.² They also paid much greater attention to the communicative dimensions of science and technology communities and organizations than previous STS work.

It is important to realize, however, that the sense of infrastructure invoked by Star, Bowker, and their colleagues was in many ways quite at odds with how the term is generally used – for example, the *Oxford English Dictionary* definition quoted at the beginning of this chapter. Instead, the new infrastructural theorists derived their understandings of infrastructure from public policy debates of their time. In seeking to develop a “national information infrastructure” in the early 1990s, US policymakers had begun to use the term to refer not to networks of computer hardware and connecting cables, as in everyday understandings of infrastructure, but rather to a whole set of services and standards that could be developed and distributed using the internet. These services and standards included those pertaining to apps and software, but now infrastructure was extended to cover the people who “create the information, develop the apps and services, construct the facilities, and train others” (IITE, cited in Frederiksen and Schmidt 2018: 184), and even “the information itself” that would be carried over the internet, such as video programming, images, scientific databases, and archives. As Frederiksen and Schmidt (2018: 184) point out, “information superstructure” would actually be a more accurate term for such people and services than information infrastructure.

Nevertheless, even though the new information infrastructural studies took up this strange definition, to include not only people but also services that were centered on media *content*, neither this new strand of research, nor the STS tradition it was aligned with, paid much attention at all to media and communication research. And it took some time after the publication of Star and her colleagues’ influential writings for the concept of infrastructure to become fashionable in media and communication studies. One of the earliest works that is regularly cited as part of the infrastructural turn in humanities and social sciences, and that actually addresses communication media, is Brian Larkin’s 2008 book on Nigeria. Larkin traced a historical shift, from the installation of media infrastructure as part of imperialist projects that sought to impose Western modernity on colonial subjects, for example via mobile cinema and radio, to the development of new infrastructures based on informal “pirate” economies, in the form of Nigeria’s booming video industry in the 2000s (Larkin 2008). His focus was still on the mundane, the ordinary and the overlooked, as in the earlier research on information infrastructures, but now with much greater attention to questions of culture and representation, and to the Global South and historical legacies of colonialism. In these respects, Larkin’s interest in infrastructure was inspired by developing critical research on the subject in anthropology and urban geography (Larkin 2013).

The real surge in media infrastructural studies came somewhat later, however, in a series of publications from around 2012 onward. A key figure has been Lisa Parks, who developed further Larkin’s interest in questions of *representation*, emphasizing “the multiple ways that [media] infrastructures have become intelligible to citizen-consumers and intersect with cultures of everyday life” (2013: 288), and focusing on the “infrastructural imaginaries” (Parks 2015: 355) that develop around media. By this term, Parks meant “ways of thinking about what infrastructures are, where they are located, who controls them, and what they do” (p. 355). In the compelling essay where she introduced this concept, Parks (2015) analyzed three contrasting examples of the representation of infrastructure: a 1903 documentary about mail sorters, a contemporary art project about telephone “linemen” (who work on the poles carrying telephone wires), and a series of photographs and videos of the destruction by police of satellite dishes in Iran. Each case demonstrated a different case of the human work involved in enabling or disabling the distribution of communication messages – and this focus on labor was to be another positive feature of the infrastructural turn in media. In another contribution, Parks (2013)

examined changing modes of the representation of communication infrastructure in maps and diagrams, and in particular how one particular layer incorporated within Google Earth, “FCC Info,” a radio and television search engine, offered a degree of transparent public information about media infrastructure in the United States, in contrast with the proprietary information created by mapping companies that sell their services to infrastructure industries themselves.

Parks also emphasized the potential methodological value of visiting infrastructure sites, a challenge taken up by, among others, Nicole Starosielski (2015), in her book on the historical development and contemporary configurations of undersea cables, which carry most of the world’s digital traffic. Starosielski visited some of the cable stations and coastal cable landing points through which digital networks pass. Her visits provided insights into how “human labor and embodied experience remain integral to the maintenance of global information exchange” (p. 98). The combination of such fieldwork with historical research and visual analysis in the work of writers such as Parks and Starosielski challenges everyday understandings of digital systems as wireless, decentralized, resilient and urban, instead showing their wired, semi-centralized, precarious, rural, and aquatic nature. Such work also valuably makes visible the materiality of media infrastructures, challenging the way in which some treatments of digital media downplay the substantial and physical nature of the systems undergirding contemporary communication.

As already indicated, an interest in the distribution or circulation of media messages is apparent in these studies. Starosielski (p. 6) comments on how media studies have tended to focus on the content, messages, and reception of digital media, paying less attention to “the infrastructures that support its distribution.” An admirable example of the contributions of infrastructure and distribution concerns to media industry studies is Ramon Lobato’s research on Netflix. As Lobato (2019: 75) points out, earlier infrastructural studies invited engagement with topics that were previously considered out of bounds by humanists, such as electrical engineering or information systems. Lobato shows that, while Netflix frequently claims to be available across the world, low bandwidth speeds mean a very much diminished Netflix experience for users in many countries, not just in the “emerging world,” but in wealthier countries such as Australia and Taiwan as well. In general, equipment and subscription costs make Netflix a service primarily for the world’s wealthier middle classes (pp. 82–85).

Lobato’s research also demonstrates how some media infrastructural studies are playing a role in pushing environmental issues belatedly up the agenda of media studies (e.g., Miller 2015). He shows how Netflix’s global lobbying for the provision of higher bandwidth shows little regard for the material and ecological consequences of the push to high-definition (HD) and Super HD. A growing body of research on data centers also pursues environmental questions (Velkova 2016), and some of it addresses the questions of representation and discourse explored by Parks in her work (Jakobsson and Stiernstedt 2012; Holt and Vonderau 2015). The role of communication infrastructures in contributing to the global climate emergency certainly needs to be even higher on the media studies agenda, but it is not the fault of infrastructural studies that more work needs to be done.

Lobato also illuminates some of the *complexity* of Netflix’s infrastructures, and the challenges for media scholars of understanding not only the telecommunications and internet governance systems on which the video streaming service relies, but also more obscure technologies such as video and audio encoding standards, metadata formatting, and user interface design standards, not to mention credit card and banking systems. A wave of media research has begun to take seriously this wider set of technologies, such as Jonathan Sterne’s (2012) work on engineering standards and audio compression in his book on the MP3 audio format, and Jeremy Morris’s (2015) history of the development of audio formats. In more recent work, the interest in “infrastructure studies” has been combined with another fashionable concept, that of platforms, as

powerful tech companies increasingly invest in infrastructure, strengthening their control over global communication (Plantin, Lagoze, Edwards, and Sandvig 2018).³

Problems and limitations

The above developments are welcome, for reasons just outlined, but the infrastructural turn has been hindered by definitional and conceptual problems. Over the last year, my email inbox has regularly contained messages advertising events, symposia, and seminars featuring “infrastructures” in their titles. To read these messages is disorienting. A call for papers for a conference at Humboldt University, Berlin, on *Digital Truth-making: Ethnographic Perspectives on Practices, Infrastructures and Affordances of Truth-making in Digital Societies*, for example, observes that “the ubiquity of digital infrastructures has brought about numerous drastic changes to a globalized world,” but the text that follows suggests that infrastructure is being used essentially to refer to what not so long ago would have been called “digital networks” or “the internet.”⁴ Another call for papers, this time for an event addressing “feminist approaches to digital infrastructures, cultures and economies” refers to “algorithmic processes of selection, identification and discrimination” – but it is not at all clear in what way the organizers understand algorithms to be “infrastructural.”⁵ A three-day workshop *Knowledge Infrastructures and Digital Governance. History, Challenges, Practices* at the University of Luxembourg promises exploration of how “digital knowledge infrastructures ... frame themselves, evolve and adapt,” and of their role in fostering “innovative models of governance.”⁶ However, the only example the organizers provide of such a digital knowledge infrastructure is Wikipedia, and it seems bizarre to conceptualize Wikipedia in this way, rather than as a website (some might describe Wikipedia as a “platform,” but it isn’t really one of those either). Even the most accomplished published work shows the definitional strain. Davis, Fenton, Freedman, and Khiabany (2020) argue for the need to discuss infrastructures of political communication, but they seem to be using the term metaphorically to refer to the importance of understanding underlying social relations. The term “infrastructure” is now used in media studies, internet studies, and related fields in such a variety of ways – as a synonym for the internet, for algorithms, for websites and for “structural” social arrangements and much else besides (see Johnson 2021) – that it is hard not to wonder whether the term is still analytically useful – see Shipwright (2017). Moreover, the confusing and inconsistent usage obscures many of the issues to which the concept might helpfully draw our attention, as evident in the work cited earlier: the mundane and often invisible, or unnoticed, materialities upon which our communication depends.

The above confusions about the meaning of the concept appear to have been inherited by contemporary media and internet research from STS-style information infrastructure studies in the Susan Leigh Star mode, and I now want to home in on some of the elisions and uncertainties that commonly occur in recent research using the term, making reference to their seeming origins in this STS work.

Materiality, hardness, and softness

The first set of confusions concern materiality, and related discussions of “hardness” and “softness.” Those advocating the “infrastructural turn” regularly claim or imply, following Star and her colleagues, that infrastructure used to refer only or primarily to hard things (pipes, cables etc.) but now refers to “soft” things too (people, protocols, organizational norms). One of the most accomplished researchers working in media and internet studies, Christian Sandvig (2013: 100), for example, observes that “the average person” would expect infrastructure

to refer to “roads, power systems, and communications networks”, but that many analysts following Star and her colleagues use infrastructure analytically “as a way to materialize the ephemera of norms and organizations”. In what sense is “materialize” being used here though? It seems to be a metaphor for “making visible” organizational ephemera rather than a reference to materiality per se, that is, the quality of being composed of *matter*. And if the analytical interest is actually in the “ephemera of norms and organizations,” why not highlight concepts, rather than fetishize infrastructure?

There is surprisingly little actual theoretical engagement with materiality as such, as opposed to non-material things such as ideas, processes, flows, discourses and so on (although of course things sometimes take material forms). In media infrastructure studies, terms such as hard, soft, and material are bandied around so freely that infrastructure could potentially cover any kind of system at all. Again, the earlier STS sociologists of infrastructure regularly provide theoretical legitimation for this vagueness. Shannon Mattern for example, cites Star and Bowker to support her view that “intellectual and institutional structures and operations – measurement standards, technical protocols, naming conventions, bureaucratic forms, etc. – are *also* infrastructures” (original emphasis; 2018: 325). Anyone expecting some kind of *explanation* of how media infrastructure in the everyday sense of the term, or even in the extended sense regularly invoked by analysts, actually works, or what effects it might have on the communication media is likely to be frustrated.⁷ This lack of interest in causality and explanation seems to be a feature of both the original STS work and the more recent media and internet studies work. In much “infrastructure studies,” the word infrastructure seems mainly to operate as a way of merely saying that entities such as norms or organizations are *fundamental*, that they metaphorically provide a *basis* for things that happen, that they *underlie* certain elements, processes, and things. But whether this fundamental or basic nature actually has causal consequences is not really explored much.

“Relationality”

Even more troubling is the constant refrain in media and information infrastructural studies that the meaning of infrastructure is, in Star and Ruhleder (1996)’s framing, “relational.” Regularly cited as an authoritative source in recent research, the piece claims that we need to ask “*when* – not *what* – is an infrastructure?” Star and Ruhleder expand on this claim by observing that infrastructure only “becomes infrastructure in relation to organized practices” (p. 113), and they give examples of different distinct practices: cooks consider the household water supply connected to the city supply as infrastructure because it helps them make dinner, but city planners and plumbers do not – for the former, it is just a variable in a complex equation, for the latter it’s something to be fixed (p. 113).

As Frederiksen and Schmidt (2018: 188–193) show, however, the argument about infrastructure being a “relational concept” is confused and confusing. What do Star and Ruhleder mean by “relational”? It is indisputable but obvious that infrastructure is relational in a very narrow sense, in that an infrastructure is always an infrastructure *of* something; otherwise it would not be an infrastructure at all. Presumably, Star and Ruhleder must mean more than this. They seem at times to intend “relational” to refer to an idea that an infrastructure is only an infrastructure when it is being used as one. But as Frederiksen and Schmidt (p. 191) remark, that would be like saying a chair is only a chair when it is being sat on, which is nonsense: unused or paused infrastructure is surely still infrastructure. Perhaps, Frederiksen and Schmidt ask, referring to the examples above, Star and Ruhleder mean that infrastructure is only an infrastructure for people who *use* it as an infrastructure – in the example above, for users such as the cook. But Frederiksen and Schmidt are surely right that the cook, the plumber and the planner all

presumably understand that they are drawing upon some kind of unified system that delivers water. Given this, why would Star and Ruhleder claim that the water supply infrastructure is infrastructure *only* for the cook and not for city planners and plumbers? Their interpretation seems completely arbitrary.

Yet, in spite of the fundamental incoherence of Star and Ruhleder's notion of relationality, their discussion is regularly invoked as authoritative even by insightful scholars. Plantin and Punathambekar (2019: 168), for example, cite them to remark that "what an infrastructure is quite simply depends on the status of the person looking (e.g. a user, or a designer)."⁸ Frederiksen and Schmidt (2018: 193) point out, referring to Star and Ruhleder, that this is not really a *relational* understanding, it is an uncomfortably *relativist* one.

Banality and vagueness

In spite of these problems, Star and Ruhleder used their sketchily "relational" conception of infrastructure as the basis for a list of properties or "dimensions" supposedly characteristic of systems they deemed infrastructural, a list that has been very widely cited in infrastructural studies. They write that infrastructures are embedded in "other structures, social arrangements and technologies," that "infrastructure has reach beyond a single event or one-site practice," and that infrastructures are learned as part of a community of practice (Star and Ruhleder 1996: 113). But these observations are rather *banal*: they are statements of the obvious that lead on to very little substantial insight into why infrastructures matter for our understanding of social or technical systems. They are also extremely vague. In each case, the word "infrastructure" might be replaced with other fundamental sociological concepts such as "organization" or "culture." If this is so, the concept surely lacks specificity. Perhaps as a result of this vagueness, Star and Ruhleder make dubious claims, such as that infrastructures only become visible once they break down (p. 113) but as Larkin points out, some infrastructures are spectacularly present, from dams to pylons to bridges, so this element of Star and Ruhleder's definition is "flatly untenable" (Larkin 2013: 336).

Does vagueness matter?

It is little wonder that with widely cited sources for the infrastructural turn offering such a thin and inconsistent conceptual foundation that the term is being used to mean so many different things. But does it matter that infrastructure is being used in varied and confusing ways, and in ways that goes beyond its everyday usage? Those who advocate infrastructure studies, within media studies and beyond, often imply that this variation in usage *doesn't* matter, and indeed that such definitional vagueness might actually be attractive, on the grounds that such vagueness might be generative of enquiry. Sandvig (2013: 89), for example, comments that

although infrastructure is at times inchoate as a concept and it holds many, sometimes inconsistent meanings for different researchers, nevertheless the term is now galvanizing a newly vibrant pool of Internet-related scholarship in the same way that equally diffuse and inconsistently applied concepts like "network" have in the past.

As I've indicated above, I think Sandvig is right about the vibrancy of some of the research on media infrastructure. And it is part of any area of intellectual enquiry that the meanings of words become extended beyond their widely used meaning into new terrains. Some humanities scholars in particular are rightly attuned to the fluidity and blurred boundaries around definitions. But the dangers of inchoateness are often underestimated by academics as they

move on busily from topic to fashionable topic. There are benefits to considering, in a more measured way, questions of conceptual robustness, even if this sometimes risks slowing down “vibrant” enquiry.

Intellectual disjuncture

It is good that a new generation of media and internet researchers is showing interest in the concept of infrastructure. Attention to the concept of infrastructure offers, as I have already indicated above, the chance to analyze the ways in which communication depends on mundane but crucial material systems in order to function. It focuses attention on processes and practices of distribution, often marginalized in the production–text–consumption triangle that still haunts media research. Some of the research undertaken in the infrastructural turn is creative and innovative in bringing issues of representation and culture to bear on such systems. However, the definitional looseness I’ve been discussing may also have reinforced another unfortunate feature of media infrastructure research: disjuncture between different traditions of research.

As I have explained, the information infrastructure research of Star and her colleagues was not concerned with infrastructure as traditionally understood, so it is perhaps not surprising that they also overlooked areas of media research that had addressed media infrastructures (at least implicitly, if not always using that term) in the original sense of the term, such as researchers concerned with the importance of telecommunications as a basis for mediated communication and information (e.g., Schiller 1981; Garnham 1990).⁹ It is strange, though, how little attention recent media infrastructural studies have paid to the large body of research on the historical development of communication networks (Mattelart 2000; Hills 2007) and their regulation (Noam 2001). Perhaps this is because such work has often been carried out in sub-fields such as political economy of media, or media policy and regulation studies, sometimes regarded with disdain by some media scholars drawn to the humanities.¹⁰ This neglect is unfortunate, because such research has cast light on important developments. Winseck (2017) for example, shows that while internet infrastructure, based on fiber optic cable, shares a basic geography with the copper that supported telegraphy and telephony, it is utterly different in terms of capacity, ownership, and regulation. The tech giants have invested in infrastructure, but they exist alongside a diverse array of other powerful players, including governments in the Global South (complicating simplistic notions of “platform imperialism”) and huge telecom companies that are hardly mentioned in the excessive focus on the famous Google, Apple, Facebook, Amazon, and Microsoft (GAFAM) tech oligopoly, such as Level 3, Global Cloud Xchange, and Tata.

Equally, recent political economy and media regulation research has paid little attention to STS-influenced work on infrastructures. Graham Murdock’s otherwise fine essay on “media and materiality” (Murdock 2018) ignores the infrastructural studies discussed earlier, for example. This means lost opportunities to understand relationships between dynamics of investment, ownership, and control, on the one hand, and the role of infrastructure in everyday life (including how “infrastructural imaginaries” shape that role), on the other. That failure of dialogue echoes the long-standing divide between political economy and cultural studies, which persists even after decades of researchers calling for greater synthesis (Hesmondhalgh 2019: 73–77). Another factor here is the preference of some humanities scholars for values of exploration, innovation and the opening up of new areas of enquiry or modes of understanding, whereas political economy and regulation analysts often seek to identify mechanisms of causation, in order to provide explanation and evaluation. Both of these forms of academic knowledge have benefits and shortcomings – and infrastructure is surely a concept that would be better understood if these different strands were brought together.

It is certainly not unusual for academics to use modish words and phrases without really defining or explaining (and sometimes without really understanding) what they mean: infrastructure is not the first, and it definitely won't be the last term to suffer from this problem. But to close, it is worth asking why the concept of infrastructure is so seemingly fashionable *now*. Part of its currency undoubtedly derives from the high quality of some of the scholarship discussed above. It also derives however from the increasing dominance in recent media studies and internet studies of “sociotechnical” as opposed to “sociocultural” research. STS was fashionable in the 2010s in a way that cultural studies was in the 1990s. Writers familiar with technology have the wind behind them compared with those who analyze video or audio content and textuality. Discussions of infrastructure regularly invoke the way that a concern with infrastructure moves “beyond” long-standing media studies concerns with production, texts, and reception. There tends to be an assumption that engagement with sociocultural and textual concerns can simply be added, as a supplement or complement, to concerns with fundamentally sociotechnical issues such as infrastructures, platforms, and distribution. The really significant and difficult question, raised by infrastructure studies but by no means resolved, is how to reconcile and synthesize those projects.

Notes

- 1 My thanks to Des Freedman, Paul McDonald and Lisa Parks for their comments on drafts, and Julia Velkova, Anne Kaun and Sander de Ridder for inviting me to the *Infrastructures and Inequalities* conference they organized at the University of Helsinki in October 2019, where I first tried out some of the ideas developed here – and where I had a brilliant laugh with a lovely group of people (special thanks to the other D. McQuail, and to Todd Johnson).
- 2 While Star's own empirical studies were elegant and stimulating, in retrospect they seem somewhat limited or unsurprising in their findings: Star and Ruhleder (1996), for example, conclude that scientists preferred web-based systems of collaboration to other early forms based on closed networks.
- 3 Some would claim that the idea of “platforms” suffers from the same problems of vague and loose usage as “infrastructures” in contemporary media studies (and beyond), and there is certainly some truth in such assertions. But I think there have been greater efforts among researchers to define what platforms might mean in analytical terms (e.g., van Dijck, Poell, and de Waal 2018).
- 4 www.carmah.berlin/events/conference-digital-truth-making-ethnographic-perspectives-on-practices-infrastructures-and-affordances-of-truth-making-in-digital-societies/.
- 5 www.kcl.ac.uk/events/algorithms-for-her.
- 6 <https://operas.hypotheses.org/3850>.
- 7 There are notable exceptions to this lack of explanation, including Starosielski (2015) and Sterne (2012), referred to above, and Paul Dourish (2015), whose essay on internet routing protocols is an unusual example in media and information infrastructural studies in explicitly conceptualizing relations between materiality and immateriality.
- 8 Sandvig (2015) distinguishes this concern with relationality from the approach of “materialists” such as Parks, who for him are guided by something like an opposite impulse: finding the material dimensions “behind” cultural phenomena.
- 9 An exception is that there tends to be some reference in infrastructural studies to the work of Harold Innis, especially Innis (1951).
- 10 Parks and Starosielski (2015: 6) are unusual in recognizing the existence of such work.

References

- Bijker, W. E., Hughes, T. P., and Pinch, T. J. (1987) *The Social Construction of Technological Systems, New Directions in the Sociology and History of Technology*, Cambridge, MA: MIT Press.
- Bowker, G. C. (1994) *Science on the Run: Information Management and Industrial Geophysics at Schlumberger, 1920–1940*, Cambridge, MA: MIT Press.

- Bowker, G. C. and Star, S. L. (1999) *Sorting Things Out: Classification and Its Consequences*, Cambridge, MA: MIT Press.
- Davis, A., Fenton, N., Freedman, D., and Khiabany, G. (2020) *Media, Democracy and Social Change*, London: SAGE.
- Dourish, P. (2015) "Protocols, Packets, and Proximity: the Materiality of Internet Routing," in L. Parks and N. Starosielski (eds), *Signal Traffic: Critical Studies of Media Infrastructures*, Urbana, IL: University of Illinois Press, 183–204.
- Frederiksen, C. L. and Schmidt, K. (2018) "A Bridge Too Far? Critical Remarks on the Concept of 'Infrastructure' in Computer-supported Cooperative Work and Information Systems", in V. Wulf, V. Pipek, D. Randall, M. Rohde, K. Schmidt, and G. Stevens (eds), *Socio-informatics: A Practice-based Perspective on the Design and Use of IT Artifacts*, Oxford: Oxford University Press: 177–217.
- Garnham, N. (1990) *Capitalism and Communication: Global Culture and the Economics of Information*, London: Sage.
- Hills, J. (2007) *Telecommunications and Empire*, Urbana, IL: University of Illinois Press.
- Holt, J. and Vonderau, P. (2015) "'Where the Internet Lives': Data Centers as Cloud Infrastructure", in L. Parks and N. Starosielski (eds), *Signal Traffic: Critical Studies Of Media Infrastructures*. Urbana: University of Illinois Press, 71–93.
- Jakobsson, P. and Stierstedt, F. (2012) "Time, Space and Clouds of Information: Data Center Discourse and the Meaning of Durability," in G. Bolin (ed.), *Cultural Technologies: The Shaping of Culture in Media and Society*. New York: Routledge, 103–118.
- Johnson, T. (2021) *Last Night an Infrastructure Saved My Life: Pipes, Sewers, Sex and Music*, Bedford Falls, NY: Jargon Press.
- Larkin, B. (2008) *Signal and Noise: Media, Infrastructure, and Urban Culture in Nigeria*, Chapel Hill, NC: Duke University Press.
- Larkin, B. (2013) "The Politics and Poetics of Infrastructure," *Annual Review of Anthropology*, 42: 327–343.
- Lobato, R. (2019) *Netflix Nations: The Geography of Digital Distribution*, New York: New York University Press.
- MacKenzie, D. A. and Wajcman, J. (1999) *The Social Shaping of Technology*, Buckingham: Open University Press.
- Mattelart, A. (2000) *Networking the World, 1794-2000*, Minneapolis, MI: University of Minnesota Press.
- Mattern, S. (2018) "Scaffolding, Hard and Soft: Critical and Generative Infrastructures," in J. Sayers (ed.), *The Routledge Companion to Media Studies and Digital Humanities*, New York: Routledge, 318–326.
- Michael, M. (2017) *Actor Network Theory: Trials, Trails and Translations*, London: SAGE.
- Miller, T. (2015) "The Art of Waste: Contemporary Culture and Unsustainable Energy Use," in L. Parks and N. Starosielski (eds), *Signal Traffic: Critical Studies of Media Infrastructures*, Urbana, IL: University of Illinois Press, 137–156.
- Morris, J. W. (2015) *Selling Digital Music, Formatting Culture*, Berkeley, CA: University of California Press.
- Murdock, G. (2018) "Media Materialities: For a Moral Economy of Machines," *Journal of Communication*, 68 (2): 359–368.
- Noam, E. M. (2001) *Interconnecting the Network of Networks*, Cambridge, MA: MIT Press.
- Oxford English Dictionary*. (n.d.). Database.
- Parks, L. (2013) "Earth Observation and Signal Territories: Studying U.S. Broadcast Infrastructure Through Historical Network Maps, Google Earth, and Fieldwork," *Canadian Journal of Communication*, 38 (3): 285–307.
- Parks, L. (2015). "'Stuff You Can Kick': Toward a Theory of Media Infrastructures," in P. Svensson and D. T. Goldberg (eds), *Between Humanities and the Digital*, Cambridge, MA: MIT Press, 355–373.
- Plantin, J.-C., Lagoze, C. Edwards, P. N., and Sandvig, C. (2018) "Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook," *New Media and Society*, 20 (1): 293–310.
- Plantin, J.-C. and Punathambekar, A. (2019). "Digital Media Infrastructures: Pipes, Platforms, and Politics," *Media, Culture and Society*, 41 (2): 163–174.
- Sandvig, C. (2013) "The Internet as Infrastructure," in W. H. Dutton (ed.), *The Oxford Handbook of Internet Studies*, Oxford: Oxford University Press, 86–108.
- Schiller, H. I. (1981) *Who Knows: Information in the Age of the Fortune 500*, Norwood, NJ: Ablex.
- Shipwright, F. (2017) "Turtles All the Way Down – Or, Escape from Infrastructure," *Transmediale*, available at <https://transmediale.de/content/turtles-all-the-way-down-or-escape-from-infrastructure> (accessed December 4, 2020).
- Star, S. L. (1999) "The Ethnography of Infrastructure," *American Behavioral Scientist*, 43 (3): 377–391.

- Star, S. L. and Ruhleder, K. (1996) "Steps Towards an Ecology of Infrastructure: Design and Access for Large Information Spaces," *Information Systems Research*, 7 (1): 111–34.
- Starosielski, N. (2015) *The Undersea Network*, Chapel Hill, NC: Duke University Press.
- Sterne, J. (2012) *MP3: The Meaning of a Format*, Chapel Hill, NC: Duke University Press.
- Streeter, T. (2011) *The Net Effect: Romanticism, Capitalism, and the Internet*, New York: New York University Press.
- Velkova, J. (2016) "Data that Warms: Waste Heat, Infrastructural Convergence and the Computation Traffic Commodity", *Big Data & Society*. doi:10.1177/2053951716684144
- Winseck, D. (2017) "The Geopolitical Economy of the Global Internet Infrastructure," *Journal of Information Policy*, 7: 228–267.