2

Platforms, Data Infrastructures, and Infrastructure Stacks

JULIE E. COHEN

2.1 Introduction

Data-driven processes extend deeply into contemporary political economies, structuring flows of economic and social activity in ways both seen and unseen. Those processes have fueled growing interest by scholars and policymakers in the idea of infrastructure, both as an analytical construct and as an object of governance. In this chapter, I use the relationship(s) between data and mobility through physical spaces to explore why the characterization of data as infrastructure might matter. I map three co-constituting processes that are reshaping flows of people and goods through physical spaces – the datafication of infrastructure, the extraction and appropriation of data, and the infrastructuralization of data – and consider the implications for both understandings of infrastructure and debates about governance of data-driven processes.

As sets of structured data flows layered over other infrastructures have multiplied and intersected with practices of data extraction and appropriation, some of those data flows – in particular, data flows maintained by entities with the resources to manipulate them in real time and at scale – have come to function as infrastructures in their own right. These shifts have destabilized existing settlements regarding the movement of people and goods. Data infrastructures (are designed to) scale both vertically and laterally; they are nimble, flexible, and adaptable to new uses. Therefore, although they lack the brute fixity of physical infrastructures such as roadways and bridges, they facilitate assertions of power in ways that physical infrastructures alone cannot, and they are also vulnerable to commandeering and cooptation. We will see that the emergence

The author wishes to thank the participants in the workshop on Global Governance by Data for their comments and Evan Cernea, Rasheed Evelyn, Yang Guo, Conor Kane, and Sherry Tseng for research assistance.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

of data infrastructures has both enabled control and coordination of formerly distinct activities and afforded points of entry for new assertions of political and geopolitical power.

Conceptualizing data as infrastructure sheds useful light on contemporary legal and regulatory debates about platform power and ways of constraining it. In particular, the infrastructure lens helps to explain some of the challenges that efforts at post hoc regulatory supervision of platform activities have faced, and it also suggests some important questions about the newer, platform-specific regulatory models that are now beginning to emerge.

2.2 Data as Infrastructure?

Although for many, the term "infrastructure" conjures up images of roads, bridges, pipes, and electrical cables, the term has long been used in a more capacious way within scholarly and policy discourses to describe a broader range of standardized arrangements that facilitate flows of human activity and exchange across spaces and scales. In particular, over the last several decades, contemporary thinking about the role of infrastructure in the networked information economy has broadened beyond physical installations (now including digital communications networks) to consider the infrastructural effects of certain types of intangible resources. Today, networked information infrastructures, platforms, and datasets have emerged as important focal points for both analysis and contestation.

One starting point for studying infrastructures, familiar to legal scholars in subfields such as intellectual property and technology law, antitrust, and law and economics, has been Frischmann's influential formulation, in which infrastructures have three characteristics: they are consumed nonrivalrously (for at least some ranges of use); social demand is driven primarily by downstream productive activities that require the resource; and they serve as inputs into a wide range of private, public, and social goods and services.[1] One noteworthy aspect of this definition is the extent to which it detaches infrastructure from physical or tangible form; so, for example, an infrastructure might be a network of roads or fiber optic cables, or it might be a common linguistic or cultural environment. Another is the extent to which it is agnostic about

[1] BM Frischmann, *Infrastructure: The Social Value of Shared Resources* (OUP 2012).

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

management structure; that agnosticism enables Frischmann to explore how choices about ownership and management of infrastructural resources shape the patterns of downstream relationships and uses.

It is also important, however, to attend to the ways that infrastructures emerge and evolve over time and to the particular technological and sociotechnical configurations they impose – topics of pressing importance in an era of rapid sociotechnical change. Because of their scale and the investment they require, infrastructures can be the objects of deliberate construction. But infrastructures also can emerge in more piecemeal and less coordinated ways. They also can emerge via carefully strategized efforts at capture. And infrastructuring projects of all sorts have sociotechnical predicates that reflect both consciously determined priorities and unexamined choices.

Work in technology studies emphasizes these considerations and foregrounds the interplay between emergence and habituation. In Star and Ruhleder's influential formulation, infrastructure becomes infrastructure when it sinks into the background, becoming a taken-for-granted way of mediating "the tension between local and global" in human and social relations.[2] Star and Ruhleder urge, therefore, that the important question for infrastructure studies is not "what is an infrastructure?" but rather "*when* is an infrastructure?"[3] Factors relevant to answering that question include reach and scope, embodiment of shared standards, habituation, and transparency while working as expected.

Last but not least, infrastructures have profound implications for the shape of governance and for the distribution of power within human societies. Even the idea of infrastructure has a complex political and ideological history. Coined by nineteenth-century French railway engineers as a way of describing the purpose and function of the nascent networks they were building, it was appropriated by Anglophone architects of the post–World War II military–industrial complex to describe and mobilize public–private partnerships for large-scale engineering projects to be constructed in the service of an emergent liberal-democratic global order.[4] Globally, decisions about where and how to

[2] SL Star and K Ruhleder, 'Steps Towards an Ecology of Infrastructure: Design and Access for Large Information Spaces' (1996) 7(1) *Information Systems Research* 111.

[3] Ibid 113.

[4] PA Shulman, 'What Infrastructure Really Means' (*The Atlantic*, 13 July 2021) available online at <https://bit.ly/3BKLurp>.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

provide infrastructures for essential services have long mediated relations of inclusion and exclusion, "articulat[ing] social relations to make a variety of social, institutional, and material things (im)possible."[5]

A broader formulation that attempts to encompass such considerations alongside the process- and practice-based insights of technology studies scholars is supplied by communications scholars Hallinan and Gilmore, who define infrastructure as "a technique of governance, a means of existential support, and a site of contestation."[6] In particular, they observe that infrastructures both underwrite formalized expectations about how the activities they facilitate are supposed to work and instill imaginaries that structure conscious and unconscious reasoning about the purpose(s) and social meaning(s) of those activities. As anthropologists Anand, Gupta, and Appel put it, infrastructures represent "critical locations though which sociality, governance and politics, accumulation and dispossession, and institutions and aspirations are formed, reformed, and performed."[7]

Turning more specifically to investigations of networked digital technologies, researchers in a number of fields have begun to interrogate the role(s) that digital platforms now play as (contested) infrastructures within the political economies of informational capitalism (in the USA) and party–state capitalism (in China). The largest digital platforms are increasingly indispensable to a wide variety of everyday activities in ways that illustrate Hallinan and Gilmore's conception of materially and ideologically embedded governance and Star and Ruhleder's criteria of embeddedness, habituation, transparency, and visibility upon breakdown.[8] In particular, digital platforms enact the themes of scale, formalization, and

[5] N Anand, A Gupta and H Appel, 'Introduction: Temporality, Politics, and the Promise of Infrastructure' in N Anand, A Gupta and H Appel (eds), *The Promise of Infrastructure* (Duke University Press 2018) 1, 3.

[6] B Hallinan and JN Gilmore, 'Infrastructural Politics Amidst the Coils of Control' (2021) 35 (4–5) *Cultural Studies* 617.

[7] Anand, Gupta and Appel, *supra* note 5, 4. See also JC Plantin and A Puthanambekar, 'Digital Media Infrastructures: Pipes, Platforms, and Politics' (2018) 41(2) *Media, Culture & Society* 163.

[8] JC Plantin and others, 'Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook' (2016) 20(1) *New Media & Society* 293; JC Plantin and G de Seta, 'WeChat as Infrastructure: The Techno-Nationalist Shaping of China's Digital Platforms' (2019) 12(3) *Chinese Journal of Communication* 257; S Rolf and S Schindler, 'The US-China Rivalry and the Emergence of State-Platform Capitalism' (2022) 55(5) *Economy and Space* 1255.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

imaginary in ways that are organized around logics of modularization, algorithmic intermediation, and control.[9]

Other researchers have focused more squarely on infrastructuring work performed by and through data, or what Flyverbom and Murray have called "datastructuring."[10] The idea of data as exerting (infra)structuring effects might seem paradoxical. On the one hand, "data" are not conventionally understood as having any particular structure. On the other, it is now well recognized that the term "raw data" is a misnomer: that data always reflect both their originating contexts and more particular choices about what is relevant and important to collect and measure.[11] This is equally true of the very large datasets on which machine learning and artificial intelligence processes are trained.[12] Control of very large datasets and of the processing power necessary to manipulate them in real time also have become important factors distinguishing the largest and most dominant platform providers from others.

At a nexus between these two avenues of inquiry sit the protocols by and through which data are configured, transmitted, and processed. So, for example, platform studies researchers locate proprietary protocols for data extraction and exchange at the operational center of contemporary platform-based information and communication infrastructures.[13] To similar effect, work at the intersection of technology studies and surveillance studies explores the protocological optimization of infrastructures for data-driven surveillance as a strategy for ensuring a continual flow and supply of goods and services.[14]

Returning, finally, to scholarship in law and cognate fields, other work on data as a modality of governance underscores the linkages between data and conceptions of appropriate political and economic ordering and

[9] T Gillespie, 'The Politics of "Platforms"' (2010) 12(3) *New Media & Society* 347; Plantin and others, *supra* note 8.

[10] M Flyverbom and J Murray, 'Datastructuring: Organizing and Curating Digital Traces into Action' (2018) 5 *Big Data & Society* 1. See also R Kitchin, *The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences* (SAGE 2014).

[11] GC Bowker and SL Star, *Sorting Things Out: Classification and Its Consequences* (MIT Press 2000); L Gitelman (ed), *"Raw Data" Is an Oxymoron* (MIT Press 2013).

[12] E Denton, 'On the Genealogy of Machine Learning Datasets: A Critical History of ImageNet' (2021) 8(2) *Big Data & Society* 1.

[13] T Blanke and J Pybus, 'The Material Conditions of Platforms: Monopolization Through Decentralization' (2020) 6(4) *Social Media & Society* 1; A Helmond, 'The Platformization of the Web: Making Web Data Platform Ready' (2015) 1(2) *Social Media & Society* 1; Plantin and others, *supra* note 8.

[14] A Gekker and S Hind, 'Infrastructural Surveillance' (2020) 22(8) *New Media & Society* 1414.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

highlights law's institutional entanglements with these questions. So, for example, in earlier work I have analyzed the way that the legal positioning of data as raw material available for taking and appropriation enables the large-scale extractive practices of contemporary informational capitalism.[15] As Couldry and Mejias have shown, practices of data extraction in the contemporary, globalized information economy also reenact longstanding patterns of colonialist resource appropriation.[16] Viljoen's important work on democratic data governance explores the possible ways that decisions about the appropriate uses of datasets might reflect and reinforce other collective choices.[17] Implicit in theories about data appropriation, data colonialism, and the possibility of democratic data governance is the notion that emergent sociotechnical formations surrounding data might do infrastructuring work in service of multiple, divergent political and economic futures.

In the balance of this chapter, I bring these lines of inquiry about infrastructures, platforms, data, protocols, and governance into conversation with one another, with particular focus on the infrastructural character of the massive datasets amassed by dominant, platformized providers of services for facilitating the movement of people and goods.

2.3 Mapping Mobilities

During the first two decades of the twenty-first century, the patterns that structure flows of people through physical spaces have changed dramatically, in ways that reflect three interlocking processes. The first process is the datafication of existing infrastructures for physical mobility, facilitated by networked interconnections between trackers in mobile devices and sensors installed at fixed locations including businesses and highway and transit systems. The second process involves the extraction and appropriation of mapping and mobility data by dominant providers of mapping and geolocation services. The third is the resulting infrastructuralization of mapping and mobility data: the massive datasets amassed by dominant providers of mapping and mobility services now perform the scale-spanning, existential support, and governance functions of

[15] JE Cohen, 'The Biopolitical Public Domain: The Legal Construction of the Surveillance Economy' (2018) 31(2) *Philosophy & Technology* 213; JE Cohen, *Between Truth and Power: The Legal Constructions of Informational Capitalism* (OUP 2019).

[16] N Couldry and UA Mejias, *The Costs of Connection: How Data Is Colonizing Human Life and Appropriating It for Capitalism* (Stanford University Press 2019).

[17] S Viljoen, 'A Relational Theory of Data Governance' (2021) 131(2) *Yale Law Journal* 573.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

infrastructures. At the same time, the development of data infrastructures for mapping and mobility as privatized, centrally controlled resources has shaped the kinds of mapping and mobility they afford.

Scholarship in multiple fields has explored various effects of digitally mediated transformations in human mobility. Some scholars focus on the ways that digital mediation changes the lived experience of physical spaces for individuals and communities.[18] Others explore shifts in patterns of driving, riding, and transit use, juxtaposing the ascendancy of piecework ride services like Uber and Lyft with declining use of both regulated taxicabs and public transit services.[19] Digital technologies alone did not produce these changes in the look and feel of cities; they also reflect the accumulating effects of a half century of neoliberal economic policies that fueled economic inequality and urban stratification, followed by the knockout punches of pandemic lockdown and a more durable shift toward teleworking and hybrid work arrangements.

Underlying all of these developments, however, is an infrastructural transformation that involves mapping data overlaid on roads and walkways and correlated in real time with mobility data extracted from mobile digital devices. In developed Western political economies, the principal actor in this story is Google. For nearly two decades, Google has aimed to comprehensively map the world's public roadways and provide seamless navigation assistance that includes real-time information about traffic and road conditions. Most visibly, millions of individual drivers and pedestrians use Google's flagship Maps app and the route-planning app Waze, which Google acquired in 2013, on a daily basis to locate destinations, determine probable driving and walking times, and plot routes. Uber has enterprise-level licenses to incorporate Google's mapping data into its matching and routing algorithms, as do other enterprises that need to coordinate vehicle fleets.[20] And a vast assortment of other mobile apps that incorporate location services – for transit, parking, location-based reminders, and many more – use software developer kits (SDKs) supplied by Google that embed mapping functionality. Mobile users of Apple devices rely principally on mapping functionality developed by Apple, and Apple supplies its own SDKs to app developers.

[18] See, for example, R Kitchin and M Dodge, *Code/Space: Software and Everyday Life* (MIT Press 2014); R Kitchin and others (eds), *Data and the City* (Routledge 2018).

[19] T Monahan, 'Monopolizing Mobilities: The Data Politics of Ride Hailing Platforms in North American Cities' (2020) 55 *Telematics and Informatics* 101436.

[20] B Mahaney, 'Uber Inks Agreement with Google Maps' (*AOL*, 19 July 2020) available online at <https://bit.ly/4dSEuGq>.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

In China, the principal actors are different. Although most smartphones used in China run Google's Android mobile operating system, Google's other services, including Maps, are blocked in China. Android users wanting to locate destinations and plan driving, transit, or walking routes most typically choose between the mapping and mobility apps provided by dominant search engine Baidu and dominant e-commerce and mobile payment provider Alibaba Group.[21] (In countries across the Global South where both Google and Chinese platform companies operate, Google supplies mapping and mobility services to Android users.) Apple's mapping functionality works in China, for the most part. The dominant ride-hailing company, Didi Chuxing, has its own rich troves of mapping and mobility data covering Chinese roadways.[22]

One might observe that these preliminary descriptions of data-driven mobility services feature public physical infrastructures working as they should – that is, supplying nonrivalrous inputs into downstream patterns of production and use that have shifted in ways responsive to changing societal demand. From that perspective, drivers, transit riders, and pedestrians are simply using publicly maintained roads and sidewalks as they were meant to be used, and information services such as Google's, Baidu's, Alibaba Group's, and Didi Chuxing's simply facilitate their usage more efficiently. One also might observe that consolidation of real-time mapping data under the control of dominant service providers reflects both the winner-takes-all character of network-and-standard-based processes and the background political economic conditions of informational capitalism.[23] Shared conventions about mapping that are decades and even centuries old might support multiple mapping services organized around shared but open protocols. However, ever-increasing reliance on both online search and mobile connectivity, along with the emergence of dominant providers for such services, have fueled the emergence of dominant providers of maps and mapping. Additionally, manipulating very large quantities of data in real time and across geographic scales requires processing power that very few entities are in position to command.

[21] Statista, 'Number of Monthly Active User Number (MAU) of the Leading Map Navigation Apps in China in December 2022' (*Statista*, 31 December 2022) available online at <https://bit.ly/407EU8H>.

[22] Y Kubota, 'In the New China, Didi's Data Becomes a Problem' (*Mint* and *The Wall Street Journal*, 18 July 2021) available online at <https://bit.ly/3BP6j57>.

[23] Cohen, *Between Truth and Power*, *supra* note 15.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

But Google, Apple, and their Chinese counterparts are not simply facilitating usage of public infrastructures; instead, they are playing out complicated dances of datafication, data extraction and privatization, and infrastructural transformation. Real-time mapping *by and through* platformized controllers of mapping and mobility data has become an infrastructural service in all of the senses that the previous section described. It is both a nonrivalrous demand-side input into many downstream productive activities and an embedded and taken-for-granted means of mediating mobility across local, regional, national, and global scales. It is also a technique of governance that shapes mobility throughout physical spaces. As it operates, real-time mapping constitutes and iteratively reinforces formalized expectations about always-on navigation assistance and seamless interconnections between transit options; simultaneously, it constitutes a powerful imaginary that structures conscious and unconscious reasoning about how mobility works and should work in highly informationalized societies.

In the case of Google, these processes have unfolded at the intersection of two recursive dynamics that are hallmarks of capitalist political economies. One involves systematic extraction and appropriation of public domain resources as inputs to private productive activity – typically, without acknowledgment of the value of the public contribution. As Mariana Mazzucato has shown, well-rehearsed narratives about private innovation tend to downplay (or ignore entirely) the role that public innovation has played in catalyzing technological development.[24] Data infrastructures are no different. Although Google now relies on updates from billions of user devices to refine its real-time mapping services, it initially developed those services using troves of government data provided under open access arrangements.[25] The second recursive dynamic involves systematic application of concepts of "public" and "private" to delineate resource ownership and enclosure of those resources deemed

[24] M Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths* (Anthem Press 2013); M Mazzucato, 'The Green Entrepreneurial State' in I Scoones, M Leach and P Newell (eds), *The Politics of Green Transformations* (Routledge 2015) 134–52.

[25] Alphabet Inc, 'Legal Notices for Google Maps/Google Earth and Google Maps/Google Earth APIs' (*Google*, last modified 1 February 2021) available online at <https://bit.ly/48DGEbT>; S Lin, 'Making of Maps: The Cornerstones' (*Google Blog*, 3 September 2014) available online at <https://bit.ly/3NV3iD2>; JC Plantin, 'Google Maps as Cartographic Infrastructure: From Participatory Mapmaking to Database Maintenance' (2018) 12 *International Journal of Communication* 489.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

private or proprietary.[26] In particular, Google (and Apple) continually harvest, enclose, and mine data about individual and social mobility, situating the datafication of mapping and mobility firmly within logics of extraction and capital accumulation.

In China, the party-state is a more active partner in processes of datafication, data extraction, and privatization. Use of government surveying and mapping data requires government authorization, and dominant economic actors also are more directly accountable to the party-state for their decisions and actions. In particular, as dominant technology platform companies have emerged, the party-state has both supported their global expansion and periodically asserted its ultimate authority over the design and deployment of data-driven services and data infrastructures. So, for example, in 2020 concern over the growing power of e-commerce giant Alibaba Group led the party-state to order postponement of the company's planned Shanghai and Hong Kong initial public offerings and impose unspecified personal sanctions on its CEO, Jack Ma.[27] Similarly, in 2021, after Didi Chuxing's initial public offering on Nasdaq prompted concern about the company's growing clout and its control of data related to the mobility patterns of party officials, the party-state imposed hefty penalties including a two-year moratorium on enrolling new users.[28] More recently, the party-state has enlisted Alibaba Group's and WeChat's support in its effort to develop a state-sponsored ride-hailing service that might compete with Didi's.[29]

The interlocking dynamics of data extraction and privatization and the emergent infrastructuralization of mapping and mobility data have reshaped human relationships to the physical environment. Data infrastructures for mapping and mobility suggest and reinforce route choices based on their own optimization parameters without regard to users' own knowledge of their communities or to embodied experiences of physical geographies.[30] Traffic flows mediated by data infrastructures also can be insensitive to local planning considerations. So, for example, the

[26] Cohen, *Between Truth and Power*, *supra* note 15; K Pistor, *The Code of Capital: How the Law Creates Wealth and Inequality* (Princeton University Press 2019).

[27] B Barclay, 'Jack Ma was China's Most Vocal Billionaire. Then he Vanished' (*Wired*, 13 January 2021) available online at <https://bit.ly/3NvzDjE>.

[28] T Wen Liu, 'Didi's Revival Shows China Can't Live Without Big Tech' (*Wired*, 14 February 2023) available online at <https://bit.ly/3UgIolE>.

[29] R McMorrow, 'China to Launch State-Owned Ride-Hailing App to Take on Didi' (*Financial Times*, 18 January 2023) available online at <https://bit.ly/3Ai6ANr>.

[30] On the ways that digital mediation affects embodied experiences of space and spaces, see JE Cohen, 'Cyberspace as/and Space' (2007) 107(1) *Columbia Law Review* 210.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

tendency of both Waze and (albeit to a lesser extent) Maps to route traffic around major thoroughfares during peak congestion periods has provoked repeated disputes with local authorities trying to minimize traffic through residential areas and keep traffic through smaller commercial districts to manageable levels.[31]

At the same time, infrastructuralized mapping and mobility data now implicate a range of activities that formerly may not have been understood as linked or adjacent. Some activities correspond to imperatives of capital accumulation. To maintain and sharpen their real-time mapping capabilities, dominant platform providers of mapping services offer mobile app developers SDKs that embed location tracking functionality, enabling them to capture and harvest additional traces of individual movement through physical spaces and push location-linked information, including advertisements, back to mobile devices.[32] They combine the data flows harvested in real time from users' devices with other data collected via their search, social networking, online shopping, and advertising services. In particular, dominant platform providers of mapping services like Google, Apple, Alibaba Group, and Baidu also have rich datasets covering local businesses that pay for advertising and/or accept mobile payments through services offered by the same dominant providers. This enables them to offer mobile users pointers to conveniently located purveyors of goods and services, which in turn underwrites expectations about seamless, invisible integration of mobility and commerce and instills an imaginary within which mobility and commercial convenience are both seamlessly entwined and infrastructurally provisioned. Even when users have withheld consent to merge their own data in this way, the provider can make predictive judgments about what users might want to see along their routes based on its data-driven profiling of similar users.

Nascent in the fusion of infrastructuralized mapping and mobility data with location-driven advertising, moreover, is potential for assertion of a broader range of logics and priorities. For example, given the other kinds of data about user preferences and affiliations that dominant platform providers already possess, it is not too difficult to envision mapping and mobility infrastructures services capable of routing users toward or away from minority-owned businesses or businesses friendly to their particular political tribe, or toward or away from political protests

[31] J MacFarlane, 'Your Navigation App Is Making Traffic Unmanageable' (*IEEE Spectrum*, 19 September 2019) available online at <https://bit.ly/40j41VU>.

[32] Blanke and Pybus, *supra* note 13; Gekker and Hinds, *supra* note 14. See also Helmond, *supra* note 13.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

based on their revealed affinities.[33] Assuming that such capabilities were disclosed, moreover, they are arguably consistent with an imaginary of digital mobility within which convenience – now more broadly defined to encompass a range of personal and political priorities – is infrastructurally provisioned. As a different example, although Western governments do not directly dictate the design of mapping and mobility services, their wishes and priorities regarding data retention and production do shape the design of underlying data infrastructures for mapping and mobility.[34] The now-routine production of so-called geofencing information recording all mobile devices present at particular locations and times has already destabilized longstanding legal settlements regarding fundamental rights against targeted state surveillance.[35] It is not too difficult to imagine experiments in so-called smart city governance that have the unintended (or intended) effect of enabling deepened and/or selectively targeted controls of mobility.

In China, where the party-state has supported a more pervasive datafication agenda infused with its own domestic and geopolitical aims, these capabilities are no longer only nascent. So, for example, during the COVID-19 pandemic, the dominant platform providers of mobile payment services, Alibaba Group and WeChat, developed so-called health codes that functioned as mobility passports. Links between public health databases, government ID databases, and transit system data infrastructures facilitated a new regime of permissioned mobility, in which a green code was required even to move around near one's home and yellow and red codes signaled progressively more draconian restrictions. Party-state officials have repurposed these mobility controls to anticipate and disable planned protest gatherings.[36]

In sum, contemporary data-driven mobility is both constituted and shaped by emergent data infrastructures for mapping and mobility, and data infrastructures embody distinct kinds of functionality and flexibility. Data infrastructures for mapping and mobility extend vertically, in stacks

[33] See, for example, J Zengerle, 'Can the Black Rifle Coffee Company Become the Starbucks of the Right?' (*New York Times*, 19 July 2021) <https://bit.ly/3YtIrNo>. See also Gekker and Hinds, *supra* note 14.

[34] Y Fang, 'Information Technology Companies as Evidence Intermediaries' (2024) 110(5) *Virginia Law Review* 1227.

[35] See, for example, JR Bambauer, 'Filtered Dragnets and the Anti-Authoritarian Fourth Amendment' (2024) 97(3) *Southern California Law Review* 571.

[36] XH Zhang, 'Decoding China's COVID-19 Health Code Apps: The Legal Challenges' (2022) 10(8) *Healthcare (Basel)* 1479.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

that superimpose data-driven logics and imaginaries over preexisting physical infrastructures such as roadways and transit systems, and laterally, in webs that extend tendrils of infrastructural logic into domains that formerly were more distinct, such as advertising and political protest. Their capacity to scale vertically and horizontally makes them amenable to configuration, reconfiguration, and control in ways that underlying physical infrastructures typically are not. This destabilizes preexisting, often tacit, settlements regarding the relationship(s) between infrastructure and governance.

2.4 Cartographies of Consumption

During the first two decades of the twenty-first century, flows of retail goods through physical spaces also have changed dramatically in ways that reflect the three processes identified in the preceding section. The datafication of consumption and production and the extraction and appropriation of consumption- and production-related data by two increasingly dominant providers of e-commerce services – Amazon and Alibaba Group – have fueled an increasingly pervasive infrastructuralization of commerce-related data that is remaking the commercial world. As with shifts in patterns of human mobility, the results illustrate the profoundly destabilizing potential of data infrastructures, which inheres in their capacity for lateral expansion and vertical extension and in their amenability to centralized control. The emergence of commerce-related data infrastructures is fueling far-reaching vertical and lateral reconfigurations of production and consumption relations. These shifts, covering the interlinked categories of product search, promotion, sale, and order fulfillment, have begun to reshape what is produced, how it is exchanged, and how complex sets of human activities surrounding production and consumption are organized.

The contemporary history of data-driven transformations in flows of physical goods is a story of two e-commerce giants: Amazon, which dominates retail traffic in the US, and Alibaba Group, which dominates retail traffic worldwide. In the US, Amazon now controls more than one third of overall retail sales traffic for a bewildering variety of goods ranging from books and consumer electronics to clothing and sporting equipment to personal care products to groceries.[37] It is routinely linked

[37] Finances Online, '74 Amazon Statistics You Must Know: 2023 Market Share Analysis and Data' (*Finances Online*, 25 October 2024) available online at <https://bit.ly/3CftXba>.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

to the stark decline of retail sales in shopping malls and downtowns throughout the country. Here again, changing retail sales patterns reflect many causal factors, including a half century of neoliberal trade policies designed to facilitate global supply chains for mass-produced goods sold through "big box" stores, growing economic inequality, rising urban rents, and changes in consumption patterns.[38] Amazon, however, has been uniquely positioned to capitalize on these developments by virtue of the very large datasets it has amassed and the logistic capabilities it has used the data to develop.

Alibaba Group, meanwhile, operates in many parts of the world where there was less of a preexisting brick-and-mortar retail footprint to displace. Throughout its expansion, it has focused on tapping the consuming potential of customers without credit cards and unbanked customers and businesses traditionally operating in cash-based, local economies.[39] The AliPay mobile app, designed principally for use by Chinese nationals, allows consumers to make purchases via Alibaba Group's Chinese language Taobao platform using a linked Chinese bank account. AliExpress, the Alibaba Group's global e-commerce platform designed for business-to-consumer transactions with consumers outside China, accepts both credit cards and prepaid cards denominated in a variety of currencies. (The flagship Alibaba platform, designed primarily for higher-volume business-to-business transactions between Chinese merchants and purchasers around the globe, requires at least a bank account.) AliExpress and Alibaba are used widely throughout South Asia, Australia, Africa, and the Middle East and have growing footprints in the Global North. Together, the Alibaba Group's services account for nearly half of retail traffic in China and control an estimated 25 percent share of retail sales worldwide.[40]

Both Amazon and Alibaba Group have invested heavily in datafication and data extraction. The two enterprises track individual and business

[38] A Goolsbee, 'Never Mind the Internet. Here's What's Killing Malls' (*New York Times*, 13 February 2020) available online at<https://bit.ly/4eSQ59K>.

[39] SP Chaudary, 'China's Country-as-Platform Strategy for Global Influence' (*Brookings TechStream*, 19 November 2020) available online at <https://bit.ly/3UFMbJ9>; MR King, 'The Competitive Threat from TechFins and Big Techs in Financial Services' in MR King and R Nesbitt (eds), *The Technological Revolution in Financial Services* (University of Toronto Press 2019).

[40] Y Ma, 'Alibaba Group – Statistics & Facts' (*Statista*, 14 March 2024) available online at <https://bit.ly/40y6JXK>; D Coppola, 'E-Commerce Market Share of Leading E-Retailers Worldwide in 2021, Based on GMV' (*Statista*, 5 February 2024) available online at <https://bit.ly/3YVRTbt>.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

users of their websites and mobile apps extensively, in ways that follow the patterns described in Section 2.2 above. The massive datasets amassed by the two e-commerce giants in turn have become increasingly indispensable preconditions for directing and receiving flows of goods across local, regional, national, and global scales. For consumers, they underwrite formalized expectations of next-day availability and constitute accompanying imaginaries of networked, always-on efficiency and convenience that characterize contemporary consumption patterns. For merchants, they underpin increasingly formalized expectations around the conditions of access to customers, coupled with a potent imaginary of geographically limitless commercial reach.

Also following the general pattern described in Section 2.2 above, as data infrastructures for production and consumption have coalesced, they have extended lateral tendrils into formerly distinct activities. In the case of production- and consumption-related data, these extensions have unfolded in ways enabled and constrained by different patterns of regulatory scrutiny and laxity. As competition regulators in the US and Europe have long recognized, Amazon's extensive datasets have enabled it to diversify its product offerings and to develop powerful, data-driven strategies for cross-promotion of its own products and services. In particular, it has leveraged its proprietary Prime membership program to engage in price discrimination that privileges its own offerings.[41] Alibaba Group engages in similar patterns of diversification and cross-promotion. However, as it has drawn the scrutiny of party functionaries worried about the power and transnational reach of its data harvesting and processing operations, it now must conduct its domestic operations under data protection constraints similar to those that Amazon has confronted in Europe, plus additional data nationalization and security review requirements that serve the party-state's data sovereignty goals.[42]

From the beginning, credit provision and payment processing have played central roles in Alibaba Group's growth. In particular, as noted above, it has emphasized data-driven strategies for extending credit and payment services to unbanked individuals and small businesses. Due

[41] House of Representatives Committee on the Judiciary, Subcommittee on Antitrust, Commercial and Administrative Law, *Investigation of Competition in Digital Markets: Majority Staff Report and Recommendations: Part I* (117th Congress, 2nd Sess 2020) 237–51 available online at <https://bit.ly/3YxTnYZ>.

[42] H Dorwart, G Zanfir-Fortuna and C Girot, 'China's New Comprehensive Data Protection Law: Context, Stated Objectives, Key Provisions' (*Future of Privacy Forum*, 20 August 2021) available online at <https://bit.ly/3AiOgnD>.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

largely to the fact that the Global North jurisdictions in which it primarily operates regulate credit provision and payment processing more comprehensively, Amazon has lagged behind in financial diversification efforts.

Amazon, meanwhile, which operates in a home jurisdiction lacking modern data protection regulation, has pursued lateral expansions involving sensors that extend datafication and data extraction capabilities more deeply into customers' homes and lives.[43] Amazon's Echo home speaker systems incorporate a voice-enabled assistant, Alexa, through which users can issue purchase orders that Amazon's shopping portals will fulfill, as well as requests for streamed audio and video content to be delivered via Amazon's Prime Music and Prime Video services. The Ring doorbell monitors comings and goings and also doubles as a concierge capable of superintending secure package delivery.[44] Echo and Ring, however, are stationary installations. Amazon's acquisition of iRobot, which manufactures the Roomba automated floor sweeper, enables it to take in-home consumer surveillance and voice recognition mobile, mapping the layouts, contents, and uses of living environments more comprehensively.[45]

Other lateral expansions facilitated by infrastructuralized data are merchant facing. For merchants in developed Western economies, opening a store on Amazon Marketplace has become an indispensable means of reaching customers increasingly habituated to and dependent on online shopping. In turn, operating within Amazon Marketplace is easier to do if one purchases back-end hosting and support from Amazon Web Services and if one uses Amazon's order fulfillment mechanisms to facilitate delivery.[46]

Alibaba Group, meanwhile, has taken the Chinese model of petty capitalist production global, linking family- and village-based production enterprises directly with customers at the far ends of global supply chains formerly mediated exclusively by global manufacturing and retail

[43] Subcommittee on Antitrust, Commercial and Administrative Law, *supra* note 41, 256–65.

[44] A Nguyen and E Zelickson, 'At the Digital Doorstep: How Customers Use Doorbell Cameras to Manage Delivery Workers' (*Data & Society*, 12 October 2022) available online at <https://bit.ly/3YCsUJJ>.

[45] R Knox, 'Amazon's Dangerous New Acquisition' (*The Atlantic*, 21 August 2022) available online at <https://bit.ly/4fA6Hmu>.

[46] Subcommittee on Antitrust, Commercial and Administrative Law, *supra* note 41, 240–44, 254–56.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

concerns.[47] In this effort, it has benefited from party-state efforts to dis- and re-intermediate legal infrastructures for global trade in the service of its larger geopolitical ambitions. China has constructed special trade zones to facilitate the outward flow of Chinese produced goods to buyers all over the globe. Parties transacting within the trade zones can expect relatively efficient, seamless customs procedures and can call upon special trade courts, distinct from the rest of the Chinese judicial system, to resolve trade-related disputes involving non-Chinese parties.[48] Alibaba Group's proprietary logistics hubs are both geographically proximate to and operationally linked with the special trade zones.[49]

As data infrastructures for production and consumption have scaled vertically and horizontally, they have begun to drive reconfigurations of underlying physical infrastructures for order fulfillment and delivery. Initially, Amazon relied on the US postal service and private shippers for these functions and used data provided by those entities to compute delivery times and shipping costs, while Alibaba Group relied on global shipping networks to connect local petty capitalist enterprises within China to global markets. But Amazon and Alibaba Group are no longer just users of preexisting physical shipping infrastructures. The datafication of processes for order fulfillment has enabled them to underwrite massive rearrangements of those processes designed with their own priorities in mind. Through sophisticated logistics divisions, they coordinate large and growing order fulfillment infrastructures comprised of giant warehouse hubs, fleets of freight planes and trucks, and armadas of delivery vans.[50] Both also have invested directly in cargo ships and related physical infrastructures for container shipping.[51]

[47] Lin Zhang, 'When Platform Capitalism Meets Petty Capitalism in China: Alibaba and an Integrated Approach to Platformization' (2020) 14 *International Journal of Communication* 114.

[48] Chaudary, *supra* note 39.

[49] Ibid.

[50] JP Rodrigue, 'The Distribution Network of Amazon and the Footprint of Freight Digitalization' (2020) 88 *Journal of Transport Geography* 102825; E Falcone, J Kent and B Fugate, 'Supply Chain Technologies, Interorganizational Network and Firm Performance: A Case Study of Alibaba Group and Cainiao' (2020) 50(3) *International Journal of Physical Distribution & Logistics Management* 333.

[51] K Schoolov, 'Amazon Is Making Its Own Containers and Bypassing Supply Chain Chaos with Chartered Ships and Long-Haul Planes' (*CNBC*, 4 December 2021) available online at <https://bit.ly/3NW1yJI>; RQ Li and W Han, 'Alibaba-Linked Transfar to Pour $650 Million into Container Fleet Expansion' (*Caixin Global*, 20 October 2022) available online at <https://bit.ly/3UD3ta0>.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

Data-driven rearrangements of physical infrastructures for commercial exchange have produced corresponding rearrangements of human labor, refiguring workers as datafied factors of production called up and deployed on demand. Across regional and sometimes national borders, armies of freelance and seasonal workers move in rhythms dictated by datafied flows of commerce through warehouse hubs and the circuits that connect them. Inside warehouses and freight and delivery vehicles, arrays of sensors enroll human workers within surveillant assemblages that monitor their movements and attention patterns and continually nudge them to maximize task productivity in aid of seamlessness and speed.[52]

A final set of effects is more speculative and flows from platform-based dis- and re-intermediation of information about what is produced and consumed. As the rearrangements of global commerce facilitated by Amazon and Alibaba encounter one another, two formerly distinct models for production and distribution of consumable goods – the industrial model and the petty capitalist model – now appear to be converging. Global supply chains formerly controlled by multinational firms have disaggregated. With relative ease, one can establish a storefront on Amazon and source products through Alibaba or AliExpress. Meanwhile, smaller US and European producers operating via petty capitalist modes of production can access national and global markets via their Amazon storefronts.

In sum, as the enormous and uniquely detailed datasets that Amazon and Alibaba Group have developed about patterns of production and consumption have come to function as infrastructures in their own right, they have catalyzed profound transformations of commercial activity. Those transformations produce inversions in which data-driven processes drive rearrangements of physical installations and flows, including warehouses and the land, air, and sea facilities and routes that connect them. Additionally, as data infrastructures have scaled laterally, merging formerly distinct infrastructures and formerly noninfrastructuralized functions, adjacent service-related infrastructures and activities have become the subject of active data-driven disintermediation and capture strategies.

[52] DA Hanley and S Hubbard, 'Eyes Everywhere: Amazon's Surveillance Infrastructure and Revitalizing Worker Power' (*Open Markets Institute*, 1 September 2020) available online at <https://bit.ly/3AoBeoB>; M Lenz and others, 'The Amazon Machine' (*Correctiv*, 12 December 2022) available online at <https://bit.ly/4fa4UFd>.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

2.5 Challenges of Governing Data Infrastructures

In the space of a few decades, the dominant digital platform enterprises have come to seem nearly unregulable. The exception, the emerging Chinese platform state, has achieved that status by infusing platform operations with party-state control and deputizing them for authoritarian rule, an approach that is neither viable nor desirable as a way forward for Western legal systems. Viewing platform operations through the infrastructure lens helps to explain some of the challenges that efforts at post hoc regulatory supervision of platform activities in the US and Europe have confronted. The functions performed by data infrastructures for mapping, mobility, and commerce sit at the intersection of several different kinds of legacy regulatory regimes. None, however, speaks to the distinctive considerations raised by infrastructuralization, which involve reorganization around shared standards, embedding, habituation, and transparency to critique. This exercise also suggests some questions that those tasked with implementing Europe's new experimental regime for platform governance should consider.

First and most obviously, dominant platform control and operation of data infrastructures implicate the kinds of market access concerns that are the traditional subject of antitrust and competition laws. Dominant online platforms, however, have also strained antitrust and competition frameworks to the breaking point. Competition thinking about horizontal and vertical integration of preexisting markets tends to take the contours of existing markets as given. As competition scholars and regulators now widely acknowledge, that approach is not especially useful for thinking about the types of data-driven reconfigurations that platforms effectuate.[53] Less widely acknowledged is that remedial options such as merger restrictions and breakups are mismatched to the type of infrastructural power that dominant platforms now represent, which inheres in data, protocols, and modular architectures for data collection and exchange. The infrastructure lens highlights these issues, helping to explain how dominant platforms have become ever more deeply entrenched notwithstanding a series of well-intentioned merger reviews and enforcement actions in multiple jurisdictions. Infrastructuring work

[53] Y-A de Montjoye, H Schweitzer and J Crémer, *Competition Policy for the Digital Era: Final Report* (Publication Office of the European Union 2019); Stigler Committee on Digital Platforms, *Final Report* (Stigler Center for the Study of the Economy and the State 2019).

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

is difficult to prevent one merger at a time and difficult to unwind one market at a time.

Data infrastructures for mapping, mobility, and commerce also both implicate and frustrate legacy regimes of consumer protection. As I have explained elsewhere, consumer protection regulation traditionally has emphasized information-forcing and information-blocking rules intended, together, to correct market failures, but contemporary platform-based economies comprehensively disable such strategies.[54] This is so in part because they create conditions of infoglut that frustrate regulatory efforts to ensure accurate information about goods and services.[55] To take just one example suggested by Section 2.3, pop-up storefronts governed by boilerplate agreements with Amazon or Alibaba Group and their accompanying data protocols cannot be governed in the same ways that more centralized arrangements might be. More fundamentally, however, platform-based data infrastructures replace market mechanisms with more complex tuning and allocation mechanisms that require different regulatory approaches.[56]

The European Union's new digital economy regulations attempt to create a new framework for structural oversight of platforms that incorporates elements from each of these regulatory traditions while also introducing some new requirements. The Digital Markets Act (DMA) defines obligations for large "gatekeepers" that provide one or more designated "core platform services" in the digital economy.[57] Designated gatekeepers (i.e., the very largest and most dominant platforms) may not combine or cross-use information collected through a "core platform service" with any other service.[58] So, for example, once the DMA takes effect (and following official issuance of gatekeeper designations for the relevant services), Google would be barred from integrating the datasets collected and used by Google Maps and Search and barred from integrating either of those datasets with data collected and used in its digital advertising business. Gatekeepers also may not

[54] Cohen, *Between Truth and Power*, *supra* note 15, 178–82.

[55] M Andrejevic, *Infoglut: How Too Much Information Is Changing the Way We Think and Know* (Routledge 2013).

[56] Cohen, *Between Truth and Power*, *supra* note 15; S Viljoen, J Goldenfein and L McGuigan, 'Design Choices: Mechanism Design and Platform Capitalism' (2021) 8(2) *Big Data & Society* 1.

[57] Council Regulation (EU) 2022/1925 of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 [2022] OJ L265 ('Digital Markets Act'), art. 2, ¶¶ 1–2, art. 3, ¶¶ 1–2.

[58] Digital Markets Act, art. 5, ¶ 2(b)–(c).

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

engage in self-preferencing, whether by imposing tying requirements on individual or business users or by using data generated by their business users to compete with those users.[59] They must afford interoperability to third-party content, apps, and app stores and data portability to individual and business users.[60] Additionally, designated gatekeeper providers of digital advertising services must disclose, on request, daily information about ad prices and publisher remuneration to both advertisers and publishers.[61]

The Digital Services Act (DSA), meanwhile, defines obligations for "online platforms" that make hosted content available to the public and additional, more stringent obligations for "very large online platforms" that function as central nodes in the informational economy.[62] The DSA's requirements mostly concern user-facing transparency with regard to removal or recommendation of content (including advertising) and fair process in cases of content removal.[63] Most notably for purposes of this chapter, however, online platforms that offer online commerce services must adhere to rules that permit identification and tracing of all merchants operating on their platforms.[64] Very large online platforms additionally must conduct risk assessments relating to, among others, fundamental rights and physical or mental health and safety, and they must implement mitigation measures when risks are identified.[65]

Taken together, these requirements express considerable ambivalence about the significance and durability of dominant platform power. On the one hand, the "gatekeeper" terminology seems intended to signal a new regulatory paradigm with a particular focus on structural domination of multiple, interlocking activities. On the other, many of the specific restrictions gesture backward toward traditional conceptions of competition- and transparency-related governance. They attempt to achieve

[59] Digital Markets Act, art. 5, ¶¶ 3–4, art. 6, ¶¶ 2, 5.
[60] Digital Markets Act, art. 6, ¶¶ 4, 6–7, 9.
[61] Digital Markets Act, art. 5, ¶¶ 9–10.
[62] Council Regulation (EU) 2022/2065 of 19 October 2022 on a Single Market for Digital Services and amending Directive 2000/31/EC [2022] OJ L277 ('Digital Services Act'), arts. 20–28, 33–42.
[63] Digital Services Act, arts. 17, 20–21, 26–27; see N Ranganathan, 'Regulating Influence, Timidly' (*Verfassungsblog*, 4 November 2022) available online at <https://bit.ly/4fdsTTV>; J van Hoboken and others, 'Putting the Digital Services Act into Practice: Enforcement, Access to Justice, and Global Implications' (2023) Amsterdam Law School Research Paper No. 13.
[64] Digital Services Act, arts. 29–32.
[65] Digital Services Act, arts. 34–35.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

the sort of functional disaggregation that competition scholars have recommended as means for reintroducing and protecting competition in digital markets, along with the sorts of transparency and process that scholars who study consumer protection, data protection, and content governance have long urged as means of instilling greater market responsiveness to individual choices. Neither set of restrictions acknowledges the extent to which digital platforms now function as fundamentally nonmarket mechanisms for tuning access to information and allocating goods and services.[66] Both regulations also signal tacit acceptance that certain digital platforms are dominant and likely to remain so. In particular, because some of the interoperability requirements for third-party content and apps may exacerbate data security risks to users, they may have the unintended effect of steering users toward content, apps, and other services offered or certified by gatekeepers and therefore perceived as safer.

Most notably for purposes of this chapter, the DMA and DSA do not fully engage the question of platforms' infrastructural power. As I explain elsewhere, dominant platforms have attained infrastructural scale and transparency to critique by leveraging a particular modular structure for data collection and exchange. Formally separate elements of platformized communication systems that face different users, including the interfaces and displays provided to individual and business users, the SDKs provided to app developers and information partners, and the dashboards used to transact with advertisers, are interconnected at the infrastructural level, and the linkages between those elements give data flows in the platformized economy their distinctive attributes.[67] Those flows, in turn, give rise to the enormous datasets now under the control of dominant platform providers of mapping and mobility services, and they generate the revenues to support the very large concentrations of processing power that dominant platform providers deploy.

The DMA and DSA permit most of these elements and the linkages between them to remain proprietary and undisclosed. Although dominant platforms must allow interconnection with their services, the DMA's unbundling and interoperability mandates do not appear to encompass full access to all of the modular protocols for data collection and exchange that make up a given platform's distributed "ecosystem," nor

[66] Viljoen, Goldenfein and McGuigan, *supra* note 56.
[67] JE Cohen, 'Infrastructuring the Digital Public Sphere' (2023) 25(1) *Yale Journal of Law & Technology* 1.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

do they require disclosures about the specific infrastructural arrangements through and across which data flows are directed. With the exception of a provision in the DSA requiring very large online platforms to create public searchable databases of all digital advertisements placed through the platform, neither the DMA nor the DSA mandates access to the data infrastructures amassed by dominant platforms or the processing power that dominant platforms control.[68] And, although each regulation addresses certain types of data processing, neither purports to govern data collection at all. Questions about the legitimacy of data collection and about the legitimacy of mechanisms purportedly designed to ensure genuine consent are left for data protection regulators to consider.

These issues present complex tradeoffs. As scholars of both technology law and regulation and governance have long recognized, tailoring regulatory obligations to particular technological configurations invites simply designing around them. So, for example, functional disaggregation in the digital advertising system has impeded the search for a "controller" to whom legal obligations under the General Data Protection Regulation (GDPR) might attach.[69] Relatedly, an extensive and growing literature casts doubt on the ability of the GDPR's consent provisions to achieve their intended purpose, explaining why privacy-protective preferences do not translate into privacy-protective behaviors and why individualized, notice-and-consent-based mechanisms are ineffective tools for disciplining predesigned, networked assemblages for data-driven patterning that operate at scale.[70] Simply mandating open access to dominant platform datasets, meanwhile, would exacerbate the problems the GDPR attempts to address and would risk naturalizing the predicate processes of data collection and processing as dominant platform providers have designed, implemented, and infrastructured them. Last but

[68] Digital Services Act, art. 39.

[69] M Veale, M Nouwens, and C Teixeira Santos, 'Impossible Asks: Can the Transparency and Consent Framework Ever Authorise Real-Time Bidding after the Belgian DPA Decision?' (2022) *Technology & Regulation* 12.

[70] See, for example, A Acquisti and others, 'The Economics of Privacy' (2016) 54(2) *Journal of Economic Literature* 442; S Barocas and H Nissenbaum, 'Big Data's End Run Around Anonymity and Consent' in J Lane and others (eds), *Privacy, Big Data, and the Public Good: Frameworks for Engagement* (CUP 2014); NA Draper and J Turow, 'The Corporate Cultivation of Digital Resignation' (2019) 21(8) *New Media & Society* 1824; S Gürses and J van Hoboken, 'Privacy after the Agile Turn' in E Selinger, J Polonetsky and O Tene (eds), *Cambridge Handbook of Consumer Privacy* (CUP 2018); AE Waldman, 'Cognitive Biases, Dark Patterns, and the "Privacy Paradox"' (2020) 31 *Current Issues in Psychology* 105.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

hardly least, it also would risk naturalizing and perpetuating the environmental and sustainability costs that those infrastructures create.

Here it is worth noting that data infrastructures for mapping, mobility, and commerce also implicate a very different set of regulatory traditions relating to public works and public utility infrastructures.[71] Such regimes vary a great deal – among other things, some such infrastructures (such as roads and water and sewer systems) traditionally have been publicly funded and operated, while others (such as energy systems) have relied on private provision – but all typically include public access requirements, nondiscrimination mandates, reasonable rate requirements, and subsidies for lower income users.[72] To be clear, legacy public utility regimes also do not speak to the full range of questions surrounding governance of infrastructural configuration. For example, so-called "smart" home systems that connect to electricity grids and municipal water systems raise difficult questions about privacy for which the public utility paradigm has no ready answers. And legacy public utility regimes have themselves been under sustained challenge by advocates of neoliberalized deregulation for many years. So, for example, even as systems for energy provision now confront pressing challenges related to sustainability, programs designed to govern from the edges by encouraging self-restraint in energy consumption and/or reorienting energy markets in ways that reward sustainability have achieved only limited successes. Those experiences counsel skepticism, if more were needed, toward efforts to govern data-driven infrastructures from the edges by (re)introducing more effective transparency and choice or more effective market-based competition. But older traditions of public utility regulation also contemplate more direct roles for regulators acting in the public interest.

At a more abstract level, regimes of public utility regulation are concerned with the regulation and governance of flows of human activity and exchange across scales. They are, therefore, suggestive of the needed path toward a public-regarding regime of digital infrastructure regulation.[73] If, in the information era, digital platforms have come to function as uniquely powerful and (re)configurable mobility infrastructures – as indispensable mechanisms for both facilitating and governing

[71] KS Rahman, 'The New Utilities: Private Power, Social Infrastructure, and the Revival of the Public Utility Concept' (2018) 39(5) *Cardozo Law Review* 1621.

[72] See, for example, W Boyd, 'Public Utility and the Low-Carbon Future' (2014) 61(6) *UCLA Law Review* 1614.

[73] Rahman, *supra* note 71.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003

the movement of people and goods – then the public's interest should be understood as extending to all of the mechanisms through which the data-driven infrastructuring of mapping, mobility, and commerce is performed. In particular, it should be understood as encompassing both matters of configuration – that is, the modular protocols for data collection and exchange now so thoroughly embedded in our economic and social lives – and matters of knowledge production – that is, the large datasets that both reflect and enable mobilities and the scaled-up reconfigurations of social and economic activity that they produce.

2.6 Conclusion

Data infrastructures for mapping, mobility, and commerce are remaking economic, social, and even physical geographies. Relative to physical infrastructures, their capacity to scale vertically and laterally renders them uniquely nimble, flexible, and adaptable to new uses. By the same token, however, they also facilitate assertions of both private and state power in ways that physical infrastructures alone cannot. Current approaches to public governance of the data-driven operations conducted by giant digital platforms have, largely by default, privileged post hoc interventions that do not engage platform operations on the infrastructural level. Effective governance institutions require mechanisms for asserting public interests more directly within infrastructural logics and their corresponding sociotechnical formations.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 10 Nov 2026 at 08:53:48, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009425308.003