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ARTICLE

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Legal Infrastructures: Towards a Conceptual Framework

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Abstract
This Article provides the outline for a conceptual framework focusing on legal infrastructures, comprised of socio-material assemblages and entangled legal normativities that both enable and constrain human societies. Section A introduces the growing transdisciplinary field of infrastructural studies, which employs the notion of infrastructure as a tool for analyzing the constitutive relationship between society and essential material structures. It then draws out the analytical conjunction of law and infrastructure in the role ascribed to law within existing applications of infrastructural studies and the nascent engagement with infrastructural theory within the legal discipline itself. Part II develops a conceptual framework on legal infrastructures, outlining three avenues for how thinking infrastructurally may yield new perspectives on the dynamic relationship between law, social practices, and socio-technical materiality; (a) legal infrastructures as socio-material formations that generate societal effects (b) legal infrastructures as schemes of social practice that recursively entangle to produce new configurations, and (c) legal infrastructures as distributing norms across transnational and regime boundaries.

Keywords: Infrastructures; Legal infrastructures; Legal theory; Sociology of Law; International law

Introduction

The last decades have seen an increasing interest in "infrastructures" as an analytical lens adopted across different disciplines to explore everything from physical assemblages such as rail systems and borders[1] to socio-technical structures such as digital information flows,[2] financial transactions[3] or human mobility.[4] Historically, the term "infrastructure" has been reserved for physical installations and originates from nineteenth-century French civil engineering.[5] Its modern discursive usage, however, is much broader than this. From historical studies of technical

[1]*See generally* Brian Larkin, *The Politics and Poetics of Infrastructure*, 42 ANN. REV. ANTHROPOLOGY 327 (2013); Susan Leigh Star, *The Ethnography of Infrastructure*, 43 AM. BEHAV. SCIENTIST 377 (1999).

[2]*See generally* Geoffrey C. Bowker, Julia Elyachar, Martin Kornberger, Andrea Mennicken, Peter Miller, Joanne Randa Nucho, and Neil Pollock, *Introduction to Thinking Infrastructures*, 62 RSCH. SOCIO. ORGS. 1 (2019).

[3]*See generally* Chris Clarke, *Platform Lending and the Politics of Financial Infrastructures*, 26 REV. INT'L POL. ECON. 863 (2019).

[4]*See generally* Biao Xiang & Johan Lindquist, *Migration Infrastructure*, 48 INT'L MIGRATION REV. 122 (2014).

[5]On the conceptual history of the term see Ashley Carse, *Keyword: Infrastructure: How a Humble French Engineering Term Shaped the Modern World*, *in* INFRASTRUCTURES AND SOCIAL COMPLEXITY: A COMPANION 27 (Penny Harvey et al. eds., 2016).

systems such as electric power grids and air traffic control,[6] to more recent science and technology studies ("STS") on for example classification standards, and knowledge eco-systems,[7] scholars have pointed out how infrastructures not only mediate the exchange of people, goods, and ideas across varying scales of space and time, but also represent constitutive realms for human activity that actively "draw people in" and remake the social world through their modalities.[8] As such, infrastructures have been argued to embody power, or even exercise forms of governing, and consequently their benefits and burdens are not always shared equally.

In this framework Article we explore how the notion of "infrastructures" may advance our understanding of law, its functioning and effects, and the fundamental role that legal regulation plays in shaping society. Notably, within infrastructural studies more broadly, law is rarely foregrounded as a distinct component or type of infrastructure, and at best tends to serve as a background variable.[9] Recent years, however, has seen a number of scholars take up the call for "thinking infrastructurally" about law and regulatory processes in order to explore themes such as financial markets,[10] data,[11] borders,[12] migration,[13] security,[14] development,[15] and even the nature of international law as such.[16] This emerging literature further builds on important antecedents in legal anthropology,[17] Third World Approaches to International Law (TWAIL),[18] and global administrative law[19] to shed further light on the legal regulation of public infrastructures,[20] infrastructures as public-private partnerships,[21] and the public aspects of governance that physical infrastructures exercise in practice.[22]

What unites these works is an appreciation of the purchase of the concept of infrastructure for engaging the relationship between law, materiality, and social practices, merging these elements into a singular analysis.[23] As Kingsbury and Maisley note, however, "more systematic

[6]*See generally* Terry S. Reynolds & Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880–1930*, 25 Tech. & Culture 644 (1984).

[7]*See generally* Geoffrey C. Bowker & Susan Leigh Star, Sorting Things Out (2000); Satyendra C. Pandey & Andrew Dutta, *Role of Knowledge Infrastructure Capabilities in Knowledge Management*, 17 J. Knowledge Mgmt. 435 (2013).

[8]Larkin, *supra* note 1.

[9]Star, *supra* note 1.

[10]Léna Pellandini-Simányi & Zsuzsanna Vargha, *Legal Infrastructures: How Laws Matter in the Organization of New Markets*, 42 Org. Stud. 867 (2021).

[11]Fleur Johns, #Help: Digital Humanitarianism and the Remaking of International Order (2023).

[12]Dimitri Van Den Meerssche, *Virtual Borders: International Law and the Elusive Inequalities of Algorithmic Association*, 33 Eur. J. Int'l L. 171, 171 (2022).

[13]Thomas Spijkerboer, *The Global Mobility Infrastructure: Reconceptualising the Externalisation of Migration Control*, 20 Eur. J. Migration & L. 452 (2018).

[14]Gavin Sullivan, *Law, Technology and Data-Driven Security: Infra-Legalities as Method Assemblage*, 49 J.L. & Soc'y 31 (2022) [hereinafter Sullivan, *Law, Technology and Data-Driven Security*]. *See also* Gavin Sullivan, The Law of the List: UN Counterterrorism Sanctions and the Politics of Global Security Law (2020) [hereinafter Sullivan, The Law of the List].

[15]Alejandro Rodiles, *Infrastructural Developmentalism and Its Many Types of Global Law: A Comparative Look at the UN Sustainable Development Goals and China's Belt and Road Initiative*, 10 London Rev. Int'l L. 367 (2022).

[16]Benedict Kingsbury, *Infrastructure and InfraReg: On Rousing the International Law 'Wizards of Is'*, Cambridge Int'l L.J. 171 (2019).

[17]Annelise Riles, *A New Agenda for the Cultural Study of Law: Taking on the Technicalities*, 53 Buff. L. Rev. 973 (2005).

[18]*See, e.g.*, Luis Eslava, Local Space, Global Life: The Everyday Operation of International Law and Development (2015).

[19]*See generally* Benedict Kingsbury, *The Concept of 'Law' in Global Administrative Law*, 20 Eur. J. Int'l L. 23 (2009).

[20]*See* Mariana Valverde, Infrastructure: New Trajectories in Law (2022).

[21]Mariana Valverde, Fleur E. Jones, and Jennifer Raso, *Governing Infrastructure in the Age of the "Art of the Deal": Logics of Governance and Scales of Visibility*, 41 Pol. Legal Anthropology Rev. 118 (2018).

[22]Benedict Kingsbury & Nahuel Maisley, *Infrastructures and Laws: Publics and Publicness*, 17 Ann. Rev. L. & Soc. Sci. 353 (2021).

[23]Benedict Kingsbury, *Introduction to the Symposium on Infrastructuring International Law*, 117 Am. J.Int'l L. Unbound 1 (2023).

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investigations of how infrastructure and law come together ... are only recently expanding."[24] In this context, this Article aims to more broadly explore the links between law and infrastructure by positing *legal infrastructures* as an analytical object in its own right; one that plays a unique, constitutive role in regard to both individuals, their social practices, and the socio-material structures these practices move through. Such a conceptualization of legal infrastructures brings into focus law as a relational technology for coordinating and contesting the socio-material world. It further highlights law's stratifying impact—between those who can access infrastructures, and those who are restricted or deliberately excluded from its benefits.[25]

To frame our discussion, we outline three possible analytical dimensions for a broader research agenda on *legal infrastructures*. Our aim is to bring together and add to discussions in law, legal theory, legal sociology, and infrastructural studies on how law infrastructures society, and how society infrastructures law, in a recursive relationship. The primary objective is to develop a more generally applicable research framework for analyzing legal infrastructures, taking international law as our starting point.

The Article proceeds as follows. Section A provides a brief introduction to the concept of "infrastructures" as the term is employed in infrastructural studies and identifies common threads of infrastructures as comprised of material, relational, and distributional elements. Section B moves to outline a conceptual framework for analyzing legal infrastructures by considering the concept through three analytical perspectives: On the macro level, as a socio-material formation, on the micro level, as a scheme of social practice, and on the meso level, as a means to consider how legal infrastructures distribute affects and affordances, with a particular focus on how norms move across boundaries. Section C concludes briefly by pointing to some directions for future research.

A. What Are Infrastructures?

Infrastructural studies is a sprawling field cutting across several disciplines, including science and technology studies ("STS"), anthropology, ethnography, architecture, critical geography, feminist theory, and post-/decolonial studies. Across these literatures, there remains no shared definition of the concept of infrastructures. Indeed, since the concept has blossomed, its contours may have become fuzzier. As Hetherington wryly notes, "[a]cross the humanities and social sciences, infrastructure is suddenly a buzzword of the highest and most obnoxious order."[26] Not all scholars, however, consider this to be a weakness. As Harvey and others note, perhaps "this conceptual-empirical proliferation and divergence is just what makes infrastructure so exciting at the present moment."[27]

As such, the following does not purport to provide an exhaustive review of the literature, instead, it attempts to narrow in on a number of common threads that arise between different theoretical conjunctions. The themes that emerge are: (1) A focus on (socio) materiality, emphasizing the embodying and productive power of objects and built environments; (2) an organizing aspect, underlining infrastructure's essential role in bringing things and spaces into relation and governing the movement of goods, people, information and money between them; and, relatedly, (3) a distributional affordance, foregrounding the role infrastructures play in granting the benefits of society to some, whilst restricting it for others.

[24]Kingsbury & Maisley, *supra* note 22, at 354.

[25]This element also situates the analysis in a long tradition of legal critique. *See generally* Paulo Barozzo, *Critical Legal Thought: The Case for a Jurisprudence of Distribution*, 92 U. COLO. L. REV. 1043 (2021).

[26]Kregg Hetherington, *Introduction: Keywords of the Anthropocene*, *in* INFRASTRUCTURE, ENVIRONMENT, AND LIFE IN THE ANTHROPOCENE 1, 6 (Kregg Hetherington ed., 2019).

[27]Nor for that matter has it led to "mutual indifference." *See, e.g.*, Penny Harvey, Casper Bruun Jensen, and Atsuro Morita, *Introduction: Infrastructural Complications*, *in* INFRASTRUCTURES AND SOCIAL COMPLEXITY: A COMPANION, *supra* note 5, at 6.

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I. Infrastructures are Material

Infrastructural studies has followed through several waves of scholarship—to some extent reflecting a disciplinary trajectory from Marxist historical materialism—to research on the historical and social construction of technology, and now a wider turn towards studying infrastructures in anthropology.[28] Althusser famously invoked the notion of infrastructure as an object of ethnography, using it to describe the economic base that is the edifice of the superstructure of law and ideology.[29] The first wave of infrastructural studies consequently focused on historical analyses of large technical systems, such as roads, pipes and railways, exploring among other things the social norms and practices growing from them.[30] A second wave took a more STS-inspired approach, focusing on the relations that emerge from infrastructural networks.[31] Finally, recent work in anthropology has adopted a more critical focus on infrastructures as political constructions, which work to create identities but also serve as vehicles for exclusion.[32]

What unites these different streams of research is that infrastructures are perceived as having a significant (socio-)material dimension; that they are built environments as opposed to naturally occurring phenomena.[33] For Harvey et al., infrastructures are "extended material assemblages."[34] For Larkin they are "material forms that allow for the possibility of exchange over space."[35] Hetherington contends they are "the invisible component in an ecology of material relations."[36] The concept of materiality employed in these studies tends to emphasize that infrastructures are open, contingent, and porous, thus transcending traditional subject/object and human/non-human dichotomies.[37] As such, infrastructures cannot be reduced to their material expression, nor should they be seen as just "technical objects;"[38] rather, they are "woven into the fabric of society" and their ontology derives from an ongoing interaction between the social and material.[39]

This might give the impression that all infrastructures are physical in nature, but their "material" aspect is generally more concerned with their tangible affects rather than their physicality. For instance, a highway infrastructure is embodied in materials—roads, signs, traffic lights—which is materially different to geographical paths in the natural world. However, it also connects these physical elements through particular logics and redirects their flows, thus recalibrating natural forces—speed, time, and so on. A data infrastructure, or the "information super highway," is quite similarly contained in servers and physical cable and telecommunication

[28]On this evolution see Jean-Christophe Plantin, Carl Lagoze, Paul N. Edwards, and Christian Sandvig, *Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook*, 20 New Media & Soc'y 293 (2016). *See also* Jörg Niewöhner, *Infrastructure*, Oxford Rsch. Encyc. Anthropology (2022) https://doi.org/10.1093/acrefore/9780190854584.013.128.

[29]*See generally* Louis Althusser, Ideology and Ideological State Apparatuses (1970).

[30]*See generally* Renate Mayntz & Thomas Hughes, The Development of Large Technical Systems (1989).

[31]*See generally* Geoffrey C. Bowker, Science on the Run: Information Management and Industrial Geophysics at Schlumberger, 1920-1940 (1994); Star, *supra* note 1.

[32]Larkin, *supra* note 1; Soumhya Venkatesan, Laura Bear, Penny Harvey, Sian Lazar, Laura Rival, and AbdouMaliq Simone, *Attention to Infrastructure Offers a Welcome Reconfiguration of Anthropological Approaches to the Political*, 38 Critique Anthropology 3 (2018).

[33]This is an observation similarly made by Kingsbury and Maisley in their distillation of the wider literature. *See* Kingsbury & Maisley, *supra* note 22, at 355.

[34]Harvey et al., *supra* note 27, at 5.

[35]Larkin, *supra* note 1, at 327.

[36]Kregg Hetherington, *Surveying the Future Perfect: Anthropology, Development and the Promise of Infrastructure*, *in* Infrastructures and Social Complexity, *supra* note 5, at 41.

[37]*See, e.g.*, Christopher N. Gamble, Joshua S. Hanan, and Thomas Nail, *What is New Materialism?*, 24 Angelaki 111 (2019) (discussing the distinctions and continuities between old and new materialisms).

[38]*See* Harvey et al., *supra* note 27; Niewöhner, *supra* note 28, at 1; Larkin, *supra* note 1, at 333.

[39]Carse, *supra* note 5, at 35.

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networks, but it also enables and structures a host of social engagements that equally have tangible affects.

Scholars have placed different emphases within these relationships. In STS research, infrastructures are often more defined by their networks. They are "[p]ervasive enabling resources in network form," according to Bowker et al.,[40] or a "system of substrates" which are "by definition invisible" for Star.[41] For these scholars, infrastructures typically involve the interactions of different material elements, each with their own agency.[42] Anthropologists, vice versa, tend to place more emphasis on the social element of infrastructures. For Schwenkel, infrastructures are "social assembl[ies]"[43] and for Appel et al., they are an "integral and intimate part of daily social life."[44] These scholars may agree that materiality and ideology co-produce infrastructures, but often deny that materials hold their own agency.[45] Similarly, some anthropologists object to the idea that infrastructure's societal "substrata" can be neatly defined or organized, and point out that defining an infrastructure is itself a "categorical act" that "highlights the epistemological and political commitments involved in selecting what one sees as infrastructural ... and what one leaves out."[46]

II. Infrastructures are Relational

Another common element of infrastructures arising from this literature is that infrastructures are not static, but rather constantly in motion in their internal machinery and relation to the wider world. Movement and change are thus central to their definition, which can be approached through analytical prisms of relationality, scaling, and temporality.

Infrastructures may thus be conceptualized as having a "*relational property*"[47]—something "become[s an] infrastructure in relation to organized practices."[48] For Larkin this element is equally important to their definition—infrastructures are "things and also the relation between things,"[49] whilst for Appel and others, this demands a "processual view ... of infrastructure's protean forms," appreciating how infrastructures are "constantly in formation across space and time."[50] Others again point out how infrastructures are "doubly relational" in the sense that further relations tend to arise from their inherent complexity, enabling both "internal multiplicity" and outward "connective capacities."[51] Think again of the example of the data infrastructures that work to enable other data infrastructures, such as financial markets, but also physical infrastructures like rail networks and indeed highways.

[40]Geoffrey C. Bowker, Karen Baker, Florence Millerand, and David Ribes, *Toward Information Infrastructure Studies: Ways of Knowing in a Networked Environment*, *in* International Handbook of Internet Research 98 (2010), at 98 (emphasized in original).

[41]Star, *supra* note 1, at 380.

[42]See the discussion in Venkatesan et al., *Attention to Infrastructure*, *supra* note 32.

[43]Christina Schwenkel, *The Current Never Stops: Intimacies of Energy Infrastructure in Vietnam*, *in* The Promise of Infrastructure 102, 115 (Nikhil Anand et al. eds., 2018, emphasized in original).

[44]Hannah Appel, Nikhil Anand, and Akhil Gupta, *Introduction: Temporality, Politics and the Promise of Infrastructure*, *in* The Promise of Infrastructure 1, 6 (Nikhil Anand et al. eds., 2018). Some anthropologists, however, equally centerstage the physical element of infrastructures, such as in Larkin's aesthetic politics. *See* Larkin *supra* note 1.

[45]Appel et al., *supra* note 44; Larkin, *supra* note 1.

[46]Larkin, *supra* note 1, at 329–30.

[47]Susan Leigh Star & Karen Ruhleder, *Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces*, 7 Info. Sys. Rsch. 111 (1996), at 113 (emphasis added).

[48]Star, *supra* note 1, at 380. *See also* Kingsbury & Maisley, *supra* note, 22, at 356.

[49]Larkin, *supra* note 1, at 329.

[50]Appel et al., *supra* note 44, at 12, 18. *See also* Paul N. Edwards, Geoffrey C. Bowker, Steven J. Jackson, and Robin Williams, *Introduction: An Agenda for Infrastructure Studies*, 10 J. Ass'n for Info. Sys. 364, 364 (2009).

[51]Harvey et al., *supra* note 27, at 5; Nanna Bonde Thylstrup, Daniela Agostinho, Kristin Eva Veel, and Katrine Dirckinck-Holmfeld, Infrapolitics, *Archival infrastructures and Digital Reparative Practices*, in Feminist Digital Humanities: Interventions in Praxis (2024).

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This relational aspect moreover implies a recursive relationship between infrastructures and the making of society; infrastructures are not passive or external to political, economic, social, and cultural spheres, but actively reshape them.[52] This opens up infrastructural studies to a range of different theoretical perspectives. Some maintain the structuralist heritage of infrastructural studies to focus on infrastructures as sites of class struggle and the material determination of society.[53] Others focus on the constitutive power of infrastructures as spaces for bio-politics, mediating power/knowledge and thereby exercising forms of governance.[54] A third approach, which is by now the most dominant, draws insights from praxeology, STS, actor network theory, and material semiotics to pry open infrastructures as "ecolog[ies]";[55] "a socio technical phenomena and practice relating technology, actors, and moral orders."[56] The common focus across these perspectives is the notion that infrastructures enable certain types of flows between the social and the material.

Within these processes, infrastructures move towards *scale*. Infrastructures "mediate exchange over distance," but do not necessarily have to be deep or large.[57] Thus, as Harvey and her colleagues note, "it is not so much that infrastructures have a scale;" instead, they "generate" scale through the various sites and extensions of infrastructural work, which "produce[s] settings, situations, or systems as large and others as small."[58] Infrastructures are thus open-ended and contingent.[59] They simultaneously work on multiple scales and exercise "scale-making capacities" which continuously affect reconfigurations.[60] Some scholars perceive this as a "fractal" process where patterns reproduce across scales and relations proliferate rather than emanate from infrastructuring.[61] We can see this, for instance, in the "internet of things," which connects devices to wider data infrastructures to not only share things of cultural value, but also impregnate marketing in daily life and thus the circulation of capital.

It follows that these scale-making processes are not necessarily visible. Several scholars emphasize how infrastructures as socio-technical phenomena tend to "recede into the background" which makes it difficult to uncover all of their operations.[62] This has led scholars to analytically focus on everyday processes of infrastructure maintenance and repair, or on moments of "breakdown," where visibility is heightened.[63] More recent work, however, has challenged the idea that infrastructures are necessarily invisible, pointing to the way that some infrastructures—like railroads or electric street lights—were often active symbols of state modernity.[64] Other scholars have argued that infrastructures become visible at the point of practices and the ways we as humans engage with them: "[A]dapting, tailoring, appropriating, tuning, modifying, tweaking, making, fixing, monitoring, maintaining, repairing, hacking [and] vandalizing."[65] Despite this transient nature, it is nevertheless commonly agreed that infrastructures have some degree

[52]*Id.*

[53]The spirit of this line of thinking is not necessarily outmoded, but rather seems to be less common in current literature. *See, e.g.*, Niewöhner, *supra* note 28.

[54]*See, e.g.*, Stephen J Collier, Post-Soviet Social: Neoliberalism, Social Modernity, Biopolitics (2011).

[55]*See* Star, *supra* note 1, at 379; Star & Ruhleder, *supra* note 47.

[56]Niewöhner, *supra* note 28, at 5.

[57]Larkin, *supra* note 1, at 330.

[58]Harvey et al., *supra* note 27, at 16–17 (emphasized in original).

[59]Edwards, *supra* note 50.

[60]Harvey et al., *supra* note 27, at 1.

[61]Casper B. Jensen, *Infrastructural Fractals: Revisiting the Micro-Macro Distinction in Social Theory*, 25 ENV'T & PLAN. D: SOC'Y & SPACE 832, 832 (2007).

[62]Andreas Folkers, *Existential Provisions: The Technopolitics of Public Infrastructure,* 33 Env't & Plan. D: Soc'y & Space 855, 856 (2017).

[63]Star, *supra* note 1, at 382; Bowker, *supra* note 31. *See also* Stephen Graham & Nigel Thrift, *Out of Order: Understanding Repair and Maintenance*, 24 Theory, Culture & Soc'y 10, 10 (2007).

[64]Larkin, *supra* note 1.

[65]Helena Karasti & Jeanette Blomberg, *Studying Infrastructuring Ethnographically*, 27 Comput. Supported Coop. Work 233, 240 (2018).

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of "fixity,"[66] or at least some fixed reference points or "moorings."[67] Railways and paved roads are clearly "fixed," but so are data infrastructures contained not only in servers, but also in human practices. Relatedly, scale-making processes are not necessarily linear. Infrastructures have a significant *temporal* element both in their development and across the time span of their operation, from their construction to their gradual decay. But infrastructures may also be seen as "building time and temporalities"[68] through their relational qualities and the ways in which they are experienced. As Star notes, "[o]ne person's infrastructure is another's topic, or difficulty."[69] For instance, what might be a linking road for one particularly mobile community, thereby shrinking time and space from their perspective, can also be an impediment for others, such as those engaging in traditional farming practices.

Infrastructures in this sense often project a narrative fixing of otherwise "unstable material and social environments"; making them appear as rational plans for the development of modern society.[70] Yet, in practice infrastructures often develop based on heterogeneous practices involving only partial knowledge and thus demanding ongoing improvisation and compromises.[71] The result may just as well produce more rhizomatic patterns of objects and relations, whose formations may clash, remain "out of synch" or leave gaps.[72] Thus, while infrastructures retain some spatiotemporal fixity and durability, they are thus also constantly evolving.[73] This processual element means that change is continuous and immanent; infrastructures are always in the making.[74]

III. Infrastructures are Distributional

Third, infrastructures project power and thus have consequences, primarily of a distributional nature. As Harvey and her colleagues note, whilst "anything" can be labelled an infrastructure, "to call something infrastructure has implications in and for the formation of sites of governance."[75] Infrastructures can represent state power[76] and its extension across time and space,[77] or the integration of the power of materials and networks. Infrastructures work with and through power, but also actively reconstitute power relations by iteratively repositioning individuals as better or worse off.

This shifts the analytical focus from infrastructures as a product of the social world, to the role of infrastructures in actively structuring societies. For many scholars, the distributional quality means that infrastructures are "critical sites for the distribution of life … politics and polities," and thus "to govern infrastructure … is to govern the politics of life, with all its inequalities."[78] For Kingsbury and Maisley, infrastructures actively create "infrastructural publics," and by creating publics, they should be normatively orientated towards cardinal values of "publicness," such as the desirability of preserving human autonomy.[79] At the very least, infrastructures can be

[66]Kingsbury & Maisley, *supra* note 22, at 356–57.
[67]Kevin Hannam, Mimi Sheller, and John Urry, *Editorial: Mobilities, Immobilities and Moorings*, 1 MOBILITIES 1 (2006).
[68]Hannah Appel, *Infrastructural Time*, *in* THE PROMISE OF INFRASTRUCTURE (Nikhil Anand et al. eds., 2018), at 44 (emphasized in original).
[69]Star, *supra* note 1, at 380.
[70]*See especially* Penny Harvey & Hannah Knox, *The Enchantments of Infrastructure,* 7 MOBILITIES 521, 521 (2012).
[71]*Id.*; BOWKER, *supra* note 31.
[72]Harvey et al., *supra* note 27, at 8.
[73]Kingsbury & Maisley, *supra* note 22.
[74]BOWKER & STAR, *supra* note 7.
[75]Harvey et al., *supra* note 27, at 7.
[76]Michael Mann, *The Autonomous Power of the State: Its Origins, Mechanisms and Results*, 25 EUR. J. SOCIO. 185 (1998).
[77]*See* Penny Harvey, *The Topological Quality of Infrastructural Relation: An Ethnographic Approach*, 29 THEORY, CULTURE, & SOC'Y 76, 76 (2012).
[78]Appel et al., *supra* note 44, at 21.
[79]Kingsbury & Maisley, *supra* note 22.

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the source, outcome, or conduit for social and political struggles.[80] Infrastructural projects themselves are thus often subject to contestation and conflict, as for example environmental resistance to the building of new roads or the Occupy movement against the global financial infrastructure, or public interest litigation against social media corporations.

It follows that if "infrastructures distribute power, they are also sites of vulnerability."[81] Infrastructures routinely disenfranchise groups and populations from access to trade, healthcare, public transport or social services.[82] An emerging body of scholarship now approaches these effects through a concept of "infrastructural harm" arising from "antagonism" generated by their formations "across different scales and contexts," and indeed beyond their normal expected operations.[83] Critical approaches in infrastructure studies have generally sought to problematize the contradictions arising from the modernist and liberal ideals embodied in infrastructures and their often more heterogeneous and disparate realities. For Bowker and Star, "infrastructural inversion" is an analytical strategy to unpack how infrastructures serve as "generative resource[s]" for the reconfiguration of societies.[84] Similarly, scholars in anthropology and the humanities have proposed "infrapolitics" as a collective term for the kind of acts that take place offstage or appear unobtrusive, as a means to discern the political struggles and resistance by those who are subjected to or marginalized by infrastructures.[85]

In this part, we have sought to canvass the ontological, epistemological, and critical commitments that emerge from infrastructural studies, both as a way to conceptualize infrastructures and more in terms of how to approach them as a research object. In sum, infrastructures are *material,* or with a significant material element, which is embedded in society; *relational,* highlighting their inter-dependent ontology, temporality, and scale-making capacity; and *distributional,* foregrounding their role in affording or restricting social benefits by creating flow or stoppage. Via these three dimensions, infrastructure emerges as a conceptual lens, or a productive metaphor, for cognizing how elements of the material and the social interact. Empirical studies of infrastructures have been a generative resource for inverting or looking below the surfaces to reveal, for example, an infrastructure's inner workings. Finally, infrastructural studies provides a critical focus on how infrastructures constitute power, and the sense of ordering that emerges from them. On this basis, we now turn to conceptualizing legal infrastructures by firstly canvassing the interactions between legal scholarship and infrastructural studies before outlining the core elements of our proposed framework.

B. Legal Infrastructures

The concept of legal infrastructures forwarded in this Article is one that conceives of law itself as a form of infrastructure, with the *legal* comprised of interconnected legal norms, practices, and institutions, and *infrastructure* as opening up analytical perspectives in regard to law's materiality, relational qualities and distributional aspects—in line with how the term has been developed in infrastructural studies. In broad terms, legal infrastructures can be thought of as socio-technical

[80]Bowker & Star, *supra* note 7.

[81]Appel et al., *supra* note 44, at 29.

[82]*See, e.g.*, Harvey et al., *supra* note 27; Robert Stock, *Broken Elevators, Temporalities of Breakdown, and Open Data: How Wheelchair Mobility, Social Media Activism and Situated Knowledge Negotiate Public Transport Systems*, 18 Mobilities 132, 132 (2023).

[83]Yannis Kallianos, Alexander Dunlap, and Dimitris Dalakoglou, *Introducing Infrastructural Harm: Rethinking Moral Entanglements, Spatio-temporal Dynamics, and Resistance(s)*, 20 Globalizations 829, 829 (2022).

[84]Bowker & Star, *supra* note 7, at 34–37; Wolfgang Kaltenbrunner, *Infrastructural Inversion as a Generative Resource in Digital Scholarship*, 24 Sci. & Culture 1 (2015).

[85]The term itself was coined by James C. Scott, who did not write on infrastructures but it has become central in infrastructure studies. *See generally* James C Scott, Domination and the arts of resistance: Hidden transcripts (1990). *See also* Guillaume Marche, *Why Infrapolitics Matters*, 131 Revue française d'études américaines 3 (2012).

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platforms that mediate normativity across society. On the one hand, this means that legal infrastructures have a constitutive aspect, in that they actively assemble materials and social practices in a way that alters and orders their mutual relationship. On the other hand, legal infrastructures have a technological aspect in terms of how affordances and qualities arise from law and assemblages of practices and materials are directed to flow—both of which may in turn come to iteratively shape the legal infrastructure.

Somewhat surprisingly, attention to the role of law and legal regulation is largely absent from infrastructural studies. Where it does feature, it is mainly as a background variable or sub-component, rarely subject to substantial analysis. One notable exception is Easterling's work on "extrastatecraft" and infrastructural spaces, which shows how states actively deregulate special zones in order to attract investments, finance and tourism, with a link to historical legal constructions on colonial trade and anti-piracy.[86] Law here becomes both a cause and the condition for infrastructure. Another example is Clarke's work on platform lending, which points to how financial infrastructures are often developed through "regulatory sandboxes," enabling policymakers to "live tes[t]" new regulatory measures on a more limited scale.[87] A final and incisive example is Pellandini-Simányi and Vargha's work on financial market regulation, which draws on actor network theory to argue that law itself can be thought of as an infrastructure and as such exercises a particular type of agency in regard to financial transactions, conveying specific kinds of practices or serving as a "gatekeeper" for which policies and amendments to the legal infrastructure itself can be carried out.[88]

Within the legal discipline, vice versa, infrastructural analysis is only now beginning to take proper foothold. Two principal trajectories may be seen to emerge from this scholarship.[89] The first might be called a "law *of* infrastructure" approach, insofar as it focuses on the impact of legal regulation on physical or other socio-material infrastructures in order to examine the ways in which law enables/constrains infrastructural projects and, reversely, how such infrastructures function as "components of regulatory ordering."[90] A central antecedent in this regard is law and development studies. Eslava identifies the provision of public infrastructure as foundational to the permeation of international law in local spaces.[91] Boer and others have similarly shown how law is reproduced in the interactions of public and private actors in the transnational governance of the Mekong River Basin.[92] Another line of scholarship moves from a more law and society focus to narrow in on the socio-legal elements of infrastructural projects outside of development contexts.[93] Seminal in this regard is Valverde's work on the regulatory fields underpinning large-scale infrastructural projects, with a focus on unpacking the legal dimension at different stages of development, for example financing, accreditation, and contracts.[94]

The second approach is more akin to thinking of "law *as* infrastructure," with scholarship connecting to insights from the broader field of infrastructural studies to different degrees. Rather than focusing on the impact and regulatory role of physical or other socio-material infrastructures, such an approach instead foregrounds how legal norms, practices and institutions themselves

[86]*See generally* Keller Easterling, Extrastatecraft: The Power of Infrastructure Space (2014).

[87]Clarke, *supra* note 3, at 875.

[88]Pellandini-Simányi & Vargha, *supra* note 10.

[89]In legal scholarship, the term "legal infrastructure" is occasionally used as a shorthand to describe a legal framework, or "the socially available set of legal materials that . . . actors can use to help govern relationships," but this use does not refer to infrastructural studies. *See generally* Gillian K. Hadfield, Law for a Flat World: Legal Infrastructure and the New Economy, 1 (2010).

[90]Kingsbury, *supra* note 23, at 1.

[91]Eslava, *supra* note 18.

[92]*See* Ben Boer, Philip Hirsch, Fleur Johns, Ben Saul, and Natalia Scurrah, The Mekong: A Socio-Legal Approach to River Basin Development (2016).

[93]Valverde et al., *supra* note 21.

[94]Valverde, *supra* note 20.

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move through physical infrastructures, which is often pictured as a "co-productive" or "co-constitutive" relationship. Within legal theory, this second approach holds important precursors in the structuralist orientation in critical legal studies,[95] actor network analysis of international law,[96] and global administrative law's focus on transnational regulatory ordering.[97] Cowan has shown how public infrastructures like railroads were integral for the assertion of jurisdiction to support colonialism,[98] whilst Rodiles sees new but similar transformations taking place with China's Belt Road Project,[99] and Ojomo argues that transnational public works enable regional norm diffusion.[100] Taking a more networked focus, Gordon's work reveals how legal practice and public infrastructures reciprocally stabilize global time governance.[101] Linking more explicitly to the themes prevalent in infrastructural studies drawn out above, Sullivan has analyzed global security infrastructures as relational networks,[102] and van Den Meerssche has explored the distributional impacts of AI-governed migration control.[103] Further in this vein, Keady-Tabbal and Mann have shown how the confluence of migration control and the search and rescue regime for irregular migrants at sea can serve as infrastructural violence.[104]

However, within this nascent literature emerging from these two approaches, the exact relationship between law and infrastructure still remains unresolved. Some see law as an institutional mechanism that, while constitutive for how infrastructures are built and governed, remains external to infrastructures themselves.[105] Others argue that law itself is a component of infrastructures.[106] Vice versa, it has been argued that infrastructures shape how law has developed and continues to operate,[107] or that the relationship between law and infrastructure is co-constitutive.[108] We move from these important developments to outline a concept of *legal infrastructures* with two principal points of departure. First, we conceive legal infrastructures as a *form of infrastructure* that on the one hand draws on how the concept has been developed in infrastructure studies, but on the other remains distinct from other types of infrastructure through its normative qualities and operation. Second, we argue that *infrastructural dynamics are an inherent quality of law itself*, due to law's practically constituted socio-materiality and its distributional implications for persons, goods, and capital. We now turn to unpack both arguments through an exposition of legal infrastructures as (a) socio-technical assemblages; (b) practical enactment; and (c) distributing affordances and qualities.

I. Legal Infrastructures as Social-Technical Formations

A first entry point emphasizes how and with what effects legal infrastructures are materially mediating on the macro level and how then legal infrastructures shape society by assembling

[95]David Kennedy, *Critical Theory, Structuralism and Contemporary Legal Scholarship*, 21 New Eng. L. Rev. 209 (1985).

[96]Riles, *supra* note 17.

[97]*See* Megan Donaldson & Benedict Kingsbury, *Ersatz Normativity or Public Law in Global Governance: The Hard Case of International Prescriptions for National Infrastructure Regulation*, 14 Chi. J. Int'l L. 1, 1 (2013).

[98]Deborah Cowen, *Law as Infrastructure of Colonial Space: Sketches from Turtle Island*, 117 Am. J. Int'l L. Unbound 5 (2023).

[99]Rodiles, *supra* note 15.

[100]Edefe Ojomo, *International Law and Regional Electricity Infrastructure: The West African Power Pool*, 117 Am. J. Int'l L. Unbound 16 (2023).

[101]Geoff Gordon, *Engaging an Infrastructure of Time Production with International Law*, 9 London Rev. Int'l L. 319 (2021).

[102]Sullivan, *Law, Technology, and Data-Driven Security*, *supra* note 14.

[103]Van Den Meerssche, *supra* note 12.

[104]Niamh Keady-Tabbal & Itamar Mann, *Weaponizing Rescue: Law and the Materiality of Migration Management in the Aegean*, 36 Leiden J. Int'l L. 61 (2022).

[105]Eslava, *supra* note 18; Ojomo, *supra* note 100.

[106]Gordon, *supra* note 101; Spijkerboer, *supra* note 13.

[107]Kingsbury & Maisley, *supra* note 22.

[108]Gordon, *supra* note 101; Cowen, *supra* note 98.

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materials and practices. As such, the "socio-material" qualities of legal infrastructures emerge as a space of interaction that links legal materiality and practices to distributional processes.[109]

Conceiving legal infrastructures as socio-material assemblages firstly builds from the "new materialist turn" in legal scholarship. This line of scholarship suggests that humans are embedded in socio-material networks[110] and law is a material formation insofar as it retains certain features "that transcend space and time,"[111] such as written texts, rituals of performance, and networks of argument.[112] This line of thinking thus moves from the "old materialist" imperative of exposing law as the "great concealer" of class struggles[113] to recognize that law is both autonomous but also part of us.[114] Materials can also then be seen as implicated in making legal meaning, they are not just "law's objects."[115] As Latour notes:

> Law is not made 'of law' any more than a gas pipe is made *of* gas or science *of* science. On the contrary, it is by means of steel, pipes, regulators, meters, inspectors and control rooms that gas ends up flowing uninterruptedly across Europe; and yet it is well and truly gas that circulates, and not the land, nor steel.[116]

From this perspective, law and society appear indissoluble because law is impregnated in the materiality of all things around us, but law also remains distinct from other forms of societal norms and practices because of its "mode of veridiction specific to law."[117] This invites different views on where law's materiality begins and ends, such as the significance of cultural objects legal artefacts,[118] forms of performance in (legal) spaces,[119] its multiplication through a spatially conceived "law-scape"[120] and through extensions of its "disciplinary architecture."[121]

This diversity of perspective on law's material quality has further sparked spirited debate on whether and what it means for law to have agency in this context. For Latour, law is predominantly a linguistic phenomenon that links legality to objects and events through its "regime of enunciation,"[122] whereas for Pottage, law's materiality arises when its "raw elements," texts, institutions, bodies, and the like, come together as "dispositifs"; "assemblages [that] are made up of nothing other that what they assemble."[123] Kang and Kendall on the other hand propose that "legal materiality" is a "specific mode of knowledge that transforms certain objects into *legal* materials in order to deliberate over 'matters of concern' to law."[124] The perspective that

[109]On the distinctions between material and social-material in STS, see Paul M. Leonardi, *Materiality, Sociomateriality, and Socio-Technical Systems: What Do These Terms Mean? How Are They Related? Do We Need Them?*, *in* Materiality and Organizing: Social Interaction in a Technological World 25 (Paul M. Leonardi et al. eds., 2012).

[110]*Id.*

[111]*Id.*, at 24.

[112]Hyo Yoon Kang, *Law's Materiality: Between Concrete Matters and Abstract Forms*, *in* Routledge Handbook of Law and Theory (Andreas Philipopoulos-Mihalopoulos ed., 2019).

[113]Daniel Mathews & Scott Veitch, *The Limits of Critique and the Forces of Law*, 27 Law and Critique 349, 354 (2017) (quoting Emilios Christodoulidis, Law and Reflexive Politics xiii (Francisco Laporta et al. eds., 1998)).

[114]Jessie Hohmann, *Diffuse Subjects and Dispersed Power: New Materialist Insights and Cautionary Lessons for international Law*, 34 Leiden J. Int'l L. 585 (2021).

[115]Hyo Yoon Kang & Sara Kendall, *Legal Materiality*, *in* The Oxford Handbook of Law and the Humanities 20, 22 (Simon Stern et al. eds., 2019).

[116]Bruno Latour, Making the Law: An Ethnography of the Counseil d'Etat (2009), at 212.

[117]Hyo Yoon Kang & Sara Kendall, *Introduction,* 23 Law, Text, and Culture 1, 6 (2019).

[118]Jessie Hoffman & Daniel Joyce, International Law's Objects (2018).

[119]*See, e.g.*, Miriam B. McKenna, *Designing for International Law: The Architecture of International Organizations 1922–1952*, 34 Leiden J. Int'l L. 1, 1 (2020).

[120]Andreas Philippopoulos-Mihalopoulos, Spatial justice: Body, lawscape, atmosphere (2015).

[121]Kyle McGee, Bruno Latour: The Normativity of Networks (2014), at 168.

[122]Alain Pottage, *The Materiality of What?*, 39 J.L. & Soc'y 167, 169–70 (2012).

[123]*Id.*, at 170, 181.

[124]Kang & Kendall, *supra* note 117, at 5.

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one chooses to adopt will have different analytical consequences for cognizing the role of what we commonly think of as law within a network of materials, and what we may ultimately think of as law's materialities. Think of, for example, how the law of the sea as a legal materiality long foregrounded economic and security concerns as extensions of the state's territorial control to its surrounding waters, but environmental concerns have begun to be taken into account more recently through not only law but also new institutions and practices.[125]

The concept of legal infrastructures offers further analytical traction on legal materialist scholarship by offering a fresh perspective on how law infrastructures society.[126] A legal infrastructural analysis submits that law is not only material but more specifically socio-material because its materiality was created in social processes, for specific purposes, and enables social practices.[127] Infrastructure studies similarly recognizes this as infrastructure's relational quality that arises infrastructures are "things and also the relation between things."[128] However, infrastructures are further "doubly relational" as their internal complexity recursively and symbiotically generates expansive capacities externally.[129] Following this line of thought, it can be seen how law assembles the social world.[130] Law arises from configurations of practices and materials that are structured but also structuring.[131] Put differently, law has a critical role in shaping processes and relations, but it is also itself a complex set of processes and relations shaped by external factors.[132] Suchman suggests we might think of an infrastructure (but here read, as law) as like a bridge:

> [L]ike an organization, a bridge can be viewed as an arrangement of more and less effectively stabilized material and social relations. Most obviously, of course, the stability of a bridge is a matter of its materiality, based in principles and practices of structural engineering. This material stability is inseparable, however, from the networks of social practice—of design, construction, maintenance and use—that must be put into place and maintained in order to make a bridge-building project possible, and to sustain the resulting artifact over time.[133]

Other scholars have recognized similar dynamics in the co-constitutive relation between law and infrastructure. For Cowan, the infrastructure of colonialism operates by ordering extensions that settle some social relations, but make others more fluid.[134] For Maisley international institutions circulate legal normativity through aesthetic and architectural forms,[135] and Quiroga-Villamarín likewise contends that international conference halls function as socio-technical spaces for world ordering.[136] On a more general level, Kingsbury and Maisley's theory of infrastructural publics proposes that law intervenes in technical, social and organizational worlds and they too become

[125]*See, e.g.*, Christian Bueger & Felix Mallin, *Blue Paradigms: Understanding the Intellectual Revolution in Ocean Politics*, 99 Int'l Affs. 1719 (2023).

[126]Latourian informed legal scholarship has notably been criticized for being excessively concerned with established legal networks. *See* Pottage, *supra* note 122. It has also been criticized for sacrificing reflexive perspectives on law's distributional tendencies. *See* Hohmann, *supra* note 114.

[127]Leonardi, *supra* note 109.

[128]Larkin, *supra* note 1, at 329.

[129]Harvey et al., *supra* note 27, at 6.

[130]Leonardi, *supra* note 109.

[131]*Cf.* Wanda J. Orlikowski, *Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations*, 11 Org. Sci. 404 (2000).

[132]*Cf.* Bueger & Mallin, *supra* note 125.

[133]Lucy Suchman, *Organizing Alignment: A Case of Bridge-Building*, 7 Org. 311, 316 (2000).

[134]Cowen, *supra* note 98.

[135]Nahuel Maisley, *The Infrastructure of International Law-Making: How Buildings Shape the Publicness of the Global Law-Making System*, 117 Am. J. Int'l L. Unbound 21 (2023).

[136]Daniel R. Quiroga-Villamarín, *Staging Grounds: Dialectics of the Spectacular and the Infrastructural in International Conference-Hosting*, 11 London Rev. Int'l L. 349 (2023).

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embedded in legality.[137] Thus, at a general level, we can see how legal infrastructures are the result of interactions between humans and materials, but their "stabilized material and social relations"[138] rather than being social or material, they are built environments that enable and constrain human interaction.

Law's ability to circulate and stabilize configurations of materials and practices is also an exercise of ordering, and this makes legal infrastructures socio-technical platforms. Socio-technical in this context refers to a multitude of assemblages of devices, for instance, court judgments and legal textbooks and routinized legal practices "whose interaction produce empirically observable consequence, that may, in turn, change the infrastructure itself."[139] This is a form of social ordering that occurs across different levels, or scales, as things such as "texts, devices, [and] architectures" come together to produce and reproduce certain patterns of social relations.[140] Legal infrastructures are thus also characterized by their ability to structure processes of circulation. They circulate tangible assets, such as goods, persons, or capital, but also seemingly intangible things, like cultural norms, practices, and ideologies.

This finally entails that legal infrastructures have a distributional effect—they work to *afford* or create *affordances* by enabling the space for human agency in the social structures that they move through. Legal infrastructures can then be conceived as "'sunk' into" other material, technical, or social structures.[141] Legal infrastructures play an active role in constituting or restraining power; they embody power, "route, block, challenge, or rework power"[142] and also in this way create their own "infrastructural publics."[143] Take Spijkerboer's analysis of the global mobility infrastructure where a variety of legal materials—such as visa rules, free movement regimes, and security law—connect with services and physical border and airport structures to enable some people to move near seamlessly, but obstruct mobility for others, thereby reproducing social stratifications.[144] From this example, it can further be seen how traditional boundaries or scales—whether temporal or geographical—may moreover be challenged by legal infrastructures as they enable "spatially dispersed 'communities of practice'" to interact through a common platform.[145] In short, they connect people, ideas, and power through legal technologies of governing.[146]

II. Legal Infrastructures as Practices

A second analytical entry point is conceiving legal infrastructures as schemes of practice. Legal infrastructures do not just "exist" independent of any social engagement with them. Legal norms must be sustained by continued practices that bestows legality to them.[147] As any other type of

[137]Kingsbury & Maisley, *supra* note 22.

[138]Suchman, *supra* note 133, at 316.

[139]Koray Caliskan, *Data Money: The Socio-Technical Infrastructure of Cryptocurrency Blockchains*, 49 Econ. & Soc'y 540, 543, (2020). In Leonard's terms , this element recognizes a "recursive [...] shaping of abstract social constructs and a technical infrastructure" and this "includes technology's materiality and people's localized responses to it." Leonardi, *supra* note 109, at 42.

[140]John Law, *Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity*, 5 Sys. Prac. 379, 379 (1992).

[141]Star & Ruhleder, *supra* note 47, at 113. The relationship between "structure" and "infrastructure" in contemporary law and infrastructure studies is under-theorized—largely because actor-network analysis is more ethnographical than sociological. But for a recent attempt, see Bueger & Mallin, *supra* note 125. *See also* Carse, *supra* note 5 (discussing the etymological genesis of the distinction); Althusser, *supra* note 29.

[142]Marieke de Goede & Carola Westermeier, *Infrastructural Geopolitics*, 66 Int'l Stud. Q. 1, 2 (2022).

[143]Kingsbury & Maisley, *supra* note 22, at 354.

[144]Spijkerboer, *supra* note 13.

[145]Folkers, *supra* note 62, at 855–56.

[146]*See* Spijkerboer, *supra* note 13. For a Foucauldian perspective, see also Folkers, *supra* note 145.

[147]See e.g. Jutta Brunnée & Stephen J. Toope, Legitimacy and Legality in International Law: An Interactional Account (2010).

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infrastructure,[148] legal infrastructures need be maintained and repaired. A key entry point for studying legal infrastructures is thus how practices (re)produce normative configurations across different spheres of society.

Such an analysis could follow through from an "internal point of view" that relies, at least in part, on doctrinal edifices to map out how different sources of rights and obligations impact a given issue.[149] However, a crucial benefit of legal infrastructure analysis is precisely its ability to de-center doctrine away from more obvious legal categories, and to zoom out on broader constellations of law and policy. Such configurations can be seen in traditional domains of socio-legal inquiry, as can be seen in for example Charlesworth's call for an "international law of everyday life"[150] or Engle Merry's work on "everyday understandings of the law."[151] Apposite concepts such as "epistemic community,"[152] "interpretative community"[153] and "community of practice"[154] may all shed light on different facets of a legal infrastructure such as knowledge, interpretation, and learning processes. However, instead of remaining confined to a focus on how shared practical understandings and knowledge repertoires are created, learned, and contested within such communities, a legal infrastructural analysis adds a particular concern with how normativity is organized and moves across boundaries and communities.

Another starting point for analysis may thus be to ask how legal infrastructures enable norms to be shared, contested, and enacted in a particular dialectic between structures and the social understanding of individuals. For Star, infrastructure "both shapes and is shaped by the conventions of [its] community,"[155] whilst socio-legal studies similarly casts practices as arranged by heuristics such as the pursuit of forms of capital,[156] standards of competency,[157] or intersubjective values.[158] Gordon's recent analysis of the infrastructure of global time governance is instructive here in showing how "legal practice works to stabilise expectations, or coordinate expectation horizons within the assemblage, which will condition behaviour in any given site of activity."[159] As compared to other types of socio-legal analysis, what an infrastructural analysis contributes in this context is a focus not only on social relations, but equally on the "interweaving layers of [legal-]technical integration"[160] structuring them, thereby adding a distinct new dimension. Focusing on the "technicalities" of law in this vein moreover brings back attention to formal legal rules and normative content, but in a way that seeks to understand their conjectures with legal practices, actors, ideologies, and pragmatic paradigms.[161]

A legal infrastructure may further be conceived as the product of socio-material practices because they arise from a particular and mutually constitutive relationship between social and material dynamics. This level of analysis sets the concept of legal infrastructures apart from other strands of practice theory, such as Bourdieu-inspired work or community-focused approaches

[148]*See, e.g.*, Graham & Thrift, *supra* note 63.

[149]For a restatement of Hart's theory for international law, see Jean d'Aspremont, Formalism and the Sources of International Law: A Theory of the Ascertainment of Legal Rules 1, 11 (2011).

[150]Hilary Charlesworth, *International Law: A Discipline of Crisis*, 65 Mod. L. Rev. 377, 391 (2002).

[151]Sally Engle Merry, *Everyday Understandings of the Law in Working-Class America*, 13 Am. Ethnologist 253, 253 (1986).

[152]Peter M. Haas, *Introduction: Epistemic Communities and International Policy Coordination*, 46 Int'l Orgs. 1, 3 (1992).

[153]Stanley Fish, *Fish v. Fiss*, 36 Stan. L. Rev. 1325, 1325 (1984); Stanley Fish, *Is there a Text in This Class?*, in The Authority of Interpretive Communities (1998).

[154]Etienne Wenger, Communities of Practice: Learning, Meaning and Identity 1, 1 (1998).

[155]Star, *supra* note 1, at 381.

[156]Pierre Bourdieu, *The Force of Law: Toward a Sociology of the Juridical Field*, 38 Hastings L. J. 805 (1987).

[157]Emanuel Adler & Vincent Pouliot, International Practices (2012).

[158]*See, e.g.*, Jutta Brunnée & Stephen J. Toope, Legitimacy and Legality in International Law: An Interactional Account (2010).

[159]Gordon, *supra* note 101, at 323.

[160]Niewöhner, *supra* note 28, at 2. *See also* Pellandini-Simányi & Vargha, *supra* note 10.

[161]Riles, *supra* note 17.

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discussed above, as its conception of the "material" emphasizes the productive power of materiality.[162] For some STS theorists, for example, practice is a "mangle" because it weaves together social, technological, and natural elements, as a dialectic of "de-centered" becoming.[163] From this perspective, law then no longer necessarily takes priority in ordering, but is deeply embedded in networks where agency is relational, that is, a respective balance of interactions between ontological equals.[164] John's analysis of the digitization of international humanitarianism likewise shows how "legality 'passes outside itself' and gets transmitted and shaped through a great miscellany of practices and materials."[165]

Yet, it might also be argued that law remains unique amongst forms of networked activity precisely because it is a normative enterprise. It is inasmuch "moral order" as it is a technology, which also marks its specificity as a form of practice community. As Gutwirth notes, in reference to Latour's conception of the gas pipe quoted above:

> . . . values never stand alone or move on their own; water and gas need infrastructure–not itself made of water or gas!–to be conveyed, to circulate in a network and to be brought where needed. In the same vein, the values identified (and the singular modes through which they can exist) need to be institutionalised not only in order to be sheltered and to subsist, but also to circulate and move in landscapes where they might be triggered.[166]

A crucial inroad in this regard may be to think of legal infrastructures as an ecology for legality, a "delicate balance of language and practice across communities."[167] An ecological understanding underlines that some elements of a network may be more juris-generative than others, serving to underscore law's fundamental institutional groundings and characteristic hierarchies. For instance, as Star notes, "[s]tudy a city and neglect its sewers and power supplies (as many have), and you miss essential aspects of distributional justice and planning power."[168] Overlooking how legal texts are produced, amended, and carried around or electronically transmitted across departments by bureaucrats in their day-to-day practices, may equally overlook a crucial element of how legal meaning is negotiated, reproduced, and transmitted.[169]

III. Legal Infrastructures and Normative Change

Following on from the above, legal infrastructures may finally be thought of distributing affordances and qualities, and legal normative change can result from these movements and machinations. Here, an infrastructural perspective intervenes in debates on how law changes beyond formal mechanisms,[170] such as treaty negotiations or legislative decisions. As

[162]For what they term "infrastructuralism," see generally Christian Bueger, Tobias Lieberau, Jan Stockbruegger, *Theorizing Infrastructures in Global Politics*, 67 Int'l Stud. Q. 101 (2023).

[163]Andrew Pickering, The Mangle of Practice: Time, Agency, and Science (1995), at 144.

[164]Larkin, supra note 1. *See also* Sullivan, *Law, Technology and Data-Driven Security*, *supra* note 14.

[165]Johns, *supra* note 11, at 21. On the making of legality through practices, see also Nikolas Rajkovic, Tanja Aalberts, Thomas Gammelhoft-Hansen, The Power of Legality: Practices of International Law and their Politics (2016).

[166]Serge Gutwirth, *Providing the Missing Link: Law After Latour's Passage*, *in* Latour and the Passage of Law 122, 139 (Kyle McGee ed., 2015).

[167]Star & Ruhleder, *supra* note 47, at 117.

[168]Star, *supra* note 1, at 379.

[169]Several strands of STS theory have a tradition in showing how social technological formations arise from contestation or the alignment of interests of powerful actors. *See, e.g.*, Michel Callon, *Techno-Economic Networks and Irreversibility*, *in* A Sociology of Monsters: Essays on Power, Technology and Domination 132 (John Law ed., 1991).

[170]*See, e.g.*, Paul F. Diehl & Charlotte Ku, The Dynamics of International Law (2010); Nico Krisch, *The Dynamics of International Law Redux*, 74 Current Legal Probs. 269 (2021); Joost Pauwelyn et al., Informal International Lawmaking (2012).

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infrastructures "mediate exchange over distance,"[171] thinking of law as an infrastructure directs our attention to how and with what distributional consequences legal norms, normative meaning, or argumentative techniques[172] flow through legal networks and across formal legal regime boundaries, potentially re-modulating them in the process. As such, a focus on legal infrastructures and change decenters an analysis that typically focuses on the functioning of individual legal regimes and their occasional boundary conflicts.[173] Instead, it sees flows across different legal regimes as systematic and productive, but also prone to political or socio-technical ruptures or instances of infrastructural breakdown.

First, a legal infrastructural analysis provides a lens for making visible how law changes through practices of interpretation. For formalist theories of law, legal change is typically understood as the role of the law applier in cognizing norms, from a succession of higher to lower norms or finding "fit and justification."[174] However, it is now generally recognized that much norm change at the international[175] and transnational level[176] occurs outside of formal processes and a legal infrastructural analysis offers potential for empirically analyzing these dynamics. International law most obviously changes through judicial interpretation and clarification,[177] but also via legal interpretations adopted by states or international institutions.[178] An infrastructural analysis brings attentions to the vehicles through which such interpretations are mediated, such as transnational judicial dialogue[179] or processes of soft law.[180] Take for example the evolution of the principle of *non-refoulement*, the cornerstone of international refugee law, and a regime never entrusted with a strong international supervisory or adjudicatory mechanism. Yet, the past two decades have seen the principle repeatedly addressed in litigation before regional human rights courts and UN treaty bodies, with far-ranging implications for how the principle is interpreted not only as a matter of human rights but also in respect to the 1951 Refugee Convention.[181] Far from being supported by state practice, the repeated interaction across regime boundaries may itself be seen as a driver of normative evolution.[182] This then directs our attention to how legal norms, normative meaning, and legal arguments may flow through legal infrastructures as a consequence of their role in circulating practices and materials, but also ultimately re-modulating the infrastructure itself in the process.

Second, an infrastructural analysis may be directed to how representational practices—that is, practical understandings that constitute social meaning—drive normative change.

[171]Larkin, supra note 1, at 330.

[172]Jean D'Aspremont, Epistemic Forces in International Law: Foundational Doctrines and Techniques of International Legal Argumentation 177–252 (2015).

[173]Margaret A. Young, Regime Interaction in International Law: Facing fragmentation (2012).

[174]*See, e.g.*, Ronald Dworkin, *Hard Cases*, *in* Taking Rights Seriously (1977).

[175]Thomas Kleinlein, *Matters of Interpretation: How to Conceptualize and Evaluate Change of Norms and Values in the International Legal Order*, 24 KFG Working Paper Series, Berlin Potsdam Rsch. Grp. "The International Rule of Law – Rise or Decline?" 1 (2018).

[176]Dana Burchardt, *Intertwinement of Legal Spaces in the Transnational Legal Sphere*, 30 Leiden J. Int'l L. 305 (2017).

[177]Armin von Bogdandy & Ingo Venzke, International Judicial Lawmaking: On Public Authority and Democratic Legitimation in Global Governance (2012).

[178]Ingo Venzke, How Interpretation Makes International Law: On Semantic Change and Normative Twists (2012).

[179]*See, e.g.*, Harold H. Koh, *Transnational Legal Process*, 75 Neb. L. Rev. 181 (1996).

[180]*See, e.g.*, Informal International Lawmaking (Joost Pauwelyn, Ramses Wessel, Jan Wouters eds., 2012).

[181]Thomas Gammeltoft-Hansen, Access to Asylum: International Refugee Law and the Globalisation of Migration Control (2011); Başak Çalı, Cathryn Costello, and Stewart Cunningham, *Hard Protection Through Soft Courts? Non-Refoulement Before the United Nations Treaty Bodies*, 21 German L. J. 355 (2020).

[182]Thomas Gammeltoft-Hansen & Mikael Madsen, *Regime Entanglement and Interstitial Legal Fields: The Case of Denmark and the Migration-Human Rights Nexus*, 40 Nordiques 1 (2021).

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Anthropological[183] and sociological theories[184] of law-making foreground this conceptualization already by showing how legal meaning converges and stabilizes through interactions amongst groups of actors. These practices are representational because practices produce both the subject and object of interpretation, for instance, in the co-constitutive relation of law, lawyers, and legal practice.[185] The dynamic quality of law in this context is linked to social agency; it is "coordinated human intentionality formed in partial response to perceptions of a technology's material agency."[186] The interaction of socially accepted rules of interpretation not only constrain but also create the possibility of making new legal arguments, especially when judges are confronted with cases linking different types of normative expertise.[187] Returning to the example of international refugee and human rights law above, the representational angle helps show how practices of adjudication and national politics have significantly transformed both spheres of law, such that changes in one legal regime may cause mutual impacts in the other.[188]

Third, a legal infrastructural analysis submits that law can change through networks of materials and non-representational practices, that is, through the relational qualities of matter and meaning. Seen from this perspective, "agency is [not conceived of as] an attribute but the ongoing reconfigurings of the world,"[189] as the social and material recursively "interlock" to produce new social and normative configurations.[190] Sullivan's notion of infra-legalities thus adopts a "relational process ontology" to examine the ongoing development of law, pointing to how regulatory frameworks and data infrastructure are in constant oscillation.[191] On a more structural level, Pellandini-Simányi and Vargha similarly point to the dynamic interplay between markets and legal infrastructures.[192] The ongoing reconfiguration between social and material elements shows how legal infrastructures are also subject to constant maintenance and repair, in ways that may often be intended to retain normative stability but at the same time inevitably drive normative evolution. Vice versa, external events or crises may also more radically transform or lead to breakdowns in the normative operations of a legal infrastructure. Think, for example, of the way that the COVID-19 pandemic not only grounded global air traffic to a halt, but also reconfigured mobility law in a range of areas through the introduction of health law as an overarching concern.[193]

C. Conclusion

In this Article, we have outlined a conceptual framework for focusing on legal infrastructures. Against the backdrop of a so far only nascent engagement of legal scholarship with infrastructural

[183]Riles, *supra* note 17.

[184]Yves Dezalay & Mikael Madsen, *The Force of Law and Lawyers: Pierre Bourdieu and the Reflexive Sociology of Law*, 8 Ann. Rev. L. & Soc. Sci. 433 (2012).

[185]Ingo Venzke, *Multidisciplinary Reflections on the Relationship between Professionals and The(ir) International Law*, *in* European Soc'y Int'l L., 2013 5th Research Forum: International Law as a Profession, Conference Paper, Paper No. 4, 2013).

[186]Leonardi, *supra* note 109, at 42.

[187]Nora Stappert, *Practice Theory and Change in International Law: Theorizing the Development of Legal Meaning Through the Interpretive Practices of International Criminal Courts*, 12 Int'l Theory 33 (2023).

[188]Thomas Gammeltoft-Hansen & Mikael Madsen, *supra* note 182.

[189]Karen Barad, *Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter*, 28 Signs 801, 818 (2003).

[190]Paul M. Leonardi, *When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies*, 35 MIS Q. 147, 152 (2011).

[191]Sullivan, *Law, Technology and Data-Driven Security*, *supra* note 14, at 34.

[192]Pellandini-Simányi & Vargha, *supra* note 10.

[193]Florian Hoffmann & Isadora Gonçalves, *Border Regimes and Pandemic Law in Time of COVID-19: A View from Brazil*, 114 Am. J. Int'l L. Unbound 327, 327 (2020). *See generally* Thomas Gammeltoft-Hansen, Tendayi Achiume, and Thomas Spijkerboer, *Introduction to the Symposium on COVID-19, Global Mobility and International Law*, 114 Am. J. Int'l L. Unbound 312 (2020).

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studies, we have forwarded a concept of legal infrastructures as socio-technical platforms that mediate normativity across society. Legal infrastructures thereby not only have constitutive effects, as they interrelate materials and practices in new ways, they also shape the flow of normative meaning through their technological dimension.

We have argued that legal infrastructures comprise, at least in some respects, a form of infrastructure that is different from other infrastructures due to their specifically legal forms of normative ambition and practical engagement. They exert infrastructuring effects that are specific to law, especially in regard to their distributional consequences. To unpack these aspects further, including their added value vis-à-vis other approaches in legal studies, we have outlined different ways of approaching legal infrastructure's socio-technical aspects, their practical enactment, and how they enabled norms to move both within, across, and beyond society. However, our preceding discussion also sought to outline how there is not just one way of approaching legal infrastructures. Notably, approaches might differ in whether they take doctrinal configurations as enacted through legal practices as a starting point, a more macro perspective on legal infrastructure's structuring effects, or a view that cognizes legal infrastructures primarily as relational networks.

The purchase of a legal infrastructural analysis may moreover be leveraged for different purposes. In our view, it opens up two types of research avenues in particular. On the one hand, from a critical perspective, the focus on legal infrastructure's distributional consequences may raise different types of normative debates, for example on whose concerns are taken for granted and whose are marginalized as legal meaning and outcomes are negotiated across different legal regimes and scales of analysis. On the other hand, a legal infrastructural analysis provides a different perspective to fiercely contested debates in legal theory, such as on the relative autonomy of law and what, if anything, makes law a system, as well as more specialized debates, for instance, on how law is applied, enacted, circulated, and enforced. Here, thinking of law as an infrastructure may shed new light on everyday legal work to make visible how normative regimes are interconnected, reproduced, contested, and maintained; how they constrain and enable processes of circulation; and how law's content may be changed as a result.

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