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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. Part I 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 enabling normative change across transnational and regime boundaries.

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MOBILE – Center of Excellence for Global Mobility Law – focuses on systematically studying the legal infrastructures of human mobility across geographies, social divides, travel patterns and time.

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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 border walls\(^1\) 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 has its origin in nineteenth-century French civil engineering.\(^5\) Its modern discursive usage, however, is much broader than this. From historical studies of technical systems such as electric power grids and air traffic control,\(^6\) to more recent science and technology studies (‘STS’) on e.g. classification standards, and knowledge ecosystems,\(^7\) 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 concept paper 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

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3 C Clarke, ‘Platform lending and the politics of financial infrastructures’ (2019) 26 Review of international political economy 863
4 B Xiang and J Lindquist, ‘Migration Infrastructure’ (2014) International Migration Review 122
8 See e.g. S. L. Star, ‘The ethnography of infrastructure’ (1999) 43 American behavioral scientist 377
10 F Johns, #Help: Digital Humanitarianism and the Remaking of International Order (OUP, 2023)
11 D van den Meersche, ‘Virtual Borders: International Law and the Elusive Inequalities of Algorithmic Association’ (2022) 33 European Journal of International law 171,
the nature of international law as such. This emerging literature further builds on important antecedents in legal anthropology, TWAIL, and global administrative law to shed further light on the legal regulation of public infrastructures, infrastructures as public-private partnerships, and the public aspects of governance that physical infrastructures exercise in practice.

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. As Kingsbury and Maisley note, however, ‘more systematic investigations of how infrastructure and law come together...are only recently expanding.’ 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 conceptualisation 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.

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 analysing legal infrastructures, taking international law as our starting point.

The article proceeds as follows. Part I 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. Part II moves to outline a conceptual framework for analysing 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) norms move across formal boundaries. Part III concludes briefly by pointing to some directions for future research.

18 See e.g. L Eslava, Local Space, Global Life: The Everyday Operation of International Law and Development (CUP 2015)
22 Kingsbury and Maisley (n9)
23 B Kingsbury, ‘Introduction to the Symposium on Infrastructuring International Law’ (2023) 117 AJIL Unbound 1
24 Kingsbury and Maisley, op cit
25 This element also situates the analysis in a long tradition of legal critique, see P Barozzo, ‘Critical Legal Thought: The Case for a Jurisprudence of Distribution’ (2021) 92 University of Colorado Law Review 1043
1. 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, ‘across the humanities and social sciences, infrastructure is suddenly a buzzword of the highest and most obnoxious order.’\textsuperscript{26} Not all scholars, however, consider this to be a weakness. As Harvey et al. note, perhaps ‘this conceptual-empirical proliferation and divergence is just what makes infrastructure so exciting at the present moment.’\textsuperscript{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 organising aspect, underlining infrastructures’ 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.

*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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{30} A second wave took a more STS-inspired approach, focusing on the relations that emerge from infrastructural networks.\textsuperscript{31} Finally, recent work in anthropology has adopted a more critical

\textsuperscript{26} K Hetherington, ‘Introduction. Keywords of the Anthropocene’ in K Hetherington (ed.) *Infrastructure, environment, and life in the Anthropocene* (Duke University Press, 2018)

\textsuperscript{27} Nor for that matter has it led to ‘mutual indifference,’ P Harvey, CB Jensen, and A Morita, Introduction in (Idem, eds.) *Infrastructures and social complexity: A companion* (Routledge, 2017)


\textsuperscript{29} L Althusser, *Ideology and Ideological State Apparatuses* (1970)

\textsuperscript{30} R Mayntz and TP Hughes, *The Development of Large Technical Systems* (Westview Press, 1988),

\textsuperscript{31} GC Bowker, *Science on the Run Information Management and Industrial Geophysics at Schlumberger, 1920-1940* (MIT Press, 1994) and Star op cit
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, 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 form, 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 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’ on which things are developed’ 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 assemblies’43 and for Anand et al., they are an ‘integral and intimate part of daily social life’.44 These scholars may agree that materiality and ideology co-produce

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32 Larkin op cit; S Venkatesan et al, ‘Attention to infrastructure offers a welcome reconfiguration of anthropological approaches to the political’ (2018) 38 Critique of Anthropology 3
33 An observation similarly made by Kingsbury and Maisley (op cit) in their distillation of the wider literature.
35 Larkin, op cit
36 K Hetherington, ‘Surveying the future perfect: Anthropology, development and the promise of infrastructure’ in P Harvey, C Jensen and A Morita, (eds.) Infrastructures and Social Complexity (Routledge, 2017)
37 On the distinctions (and continuities) between old and new materialisms see e.g. C Gamble, J Hanan, and T Nail, ‘What is new Materialism?’ (2019) 6 Angelaki: Journal of the Theoretical Humanities 1
38 Harvey, Jensen, and Morita, op cit; Niewöhner op cit.; Larkin, op cit.
39 Carse, op cit
42 See the discussion in S Venkatesan et al op cit
44 Appel, Anand and Gupta, op cit. Some anthropologists, however, equally centerstage the physical element of infrastructures, such as in Larkin’s ‘aesthetic politics,’ op cit.
infrastructures, but often deny that materials hold their own agency. Similarly, some anthropologists object to the idea that infrastructure’s societal ‘substrata’ can be neatly defined or organised, 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.’

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’—something ‘becomes an infrastructure in relation to organized practices.’ For Larkin this element is equally important to their definition—infrastructures are ‘things and also the relation between things,’ whilst for Appel et al., this demands a ‘processual view…of infrastructure’s protean forms’, appreciating how infrastructures are ‘constantly in formation across space and time.’ 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.’ 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.

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. 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. Others focus on the constitutive power of infrastructures as spaces for bio-politics, mediating power/knowledge and thereby exercising forms of governance. 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 ‘ecologies;’ as socio-technical phenomena and practice relating to technology, actors, and moral orders.

45 H Appel, N Anand and A Gupta op cit, Larkin
46 Larkin, op cit
47 SL Star and K Ruhleder, ‘Steps toward an ecology of infrastructure: design and access for large information spaces’ (1996) 7(1) Information Systems Research 111
48 Star op cit; see also Kingsbury and Mailsey, op cit.
49 Larkin, op cit
50 Appel, Anand and Gupta, op cit. see also Edwards, op cit.
51 Harvey, Jensen, and Morita, op cit; Thylstrup, op cit.
52 Ibid.
53 Niewöhner, op cit the spirit of this line of thinking is not necessarily outmoded, but rather seems to be less common in current literature, see e.g. Buier op cit
54 See e.g. SJ Collier, Post-Soviet Social: Neoliberalism, Social Modernity, Biopolitics (Princeton University Press, 2011).
55 See especially Star, op cit, and Star and Ruhleder, op cit.
56 Niewöhner, op cit
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 ‘big’.57 Thus, as Harvey et al. note, ‘it is not so much that infrastructures have a scale,’ but rather that they ‘generate’ scale through the various sites and extensions of infrastructural work, which produces ‘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: ‘adapting, 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 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 the ways in which they are experienced. As Star notes, ‘one person’s infrastructure is another’s topic, or difficulty.’69 For instance, what might be a linking road for one particularly mobile

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58 Harvey, Jensen, and Morita, op cit
59 Edwards, op cit
60 Harvey, Jensen, and Morita, op cit.
64 Larkin, op cit
66 Kingsbury and Maisley, op cit
69 Star, op cit.
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’.\(^{74}\)

**Infrastructures are Distributional**

Third, infrastructures project power and thus have consequences, primarily of a distributional nature. As Harvey et al. 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 or shaping the social, 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 of 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 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.

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\(^{70}\) See especially P Harvey and H Knox, ‘The enchantments of infrastructure’ (2012) 7(4) Mobilities 521
\(^{71}\) Ibid.; Bowker, op cit.
\(^{72}\) Harvey, Jensen, and Morita, op cit
\(^{73}\) Kingsbury and Maisley op cit
\(^{74}\) Bowker and Star op cit
\(^{75}\) Harvey, Jensen, and Morita, op cit
\(^{78}\) H Appel, N Anand and A Gupta op cit
\(^{79}\) Kingsbury and Maisley, op cit
\(^{80}\) Bowker and Star op cit
It follows that if ‘infrastructures distribute power, they are also sites of vulnerability.’ 

Infrastructures routinely disenfranchise groups and populations from access to trade, healthcare, public transport or social services. 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. 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 resources’ for the reconfiguration of societies. 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.

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, e.g., 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.

2. 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 platforms that mediate normative meaning across society. On the one hand, this

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81 H Appel, N Anand and A Gupta op cit
82 See e.g. Harvey, Jensen and Morita, op cit; R Stock, ‘Broken elevators, temporalities of breakdown, and open data: how wheelchair mobility, social media activism and situated knowledge negotiate public transport systems’ (2023) 18(1) Mobilities 132.
83 Y Kallianos, A Dunlap and D Dalakoglou, ‘Introducing infrastructural harm: rethinking moral entanglements, spatio-temporal dynamics, and resistance(s),’ (2022) Globalizations 1
84 Bowker and Star, op cit.; see also W Kaltebrunner, ‘Infrastructural Inversion as a Generative Resource in Digital Scholarship’ (2015) 24(1) Science and Culture 1
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 normative meaning is enabled to flow, and how it relates to assemblages of practices and materials, – 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.\(^\text{86}\) 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 test’ new regulatory measures on a more limited scale.\(^\text{87}\) 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.\(^\text{88}\)

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.\(^\text{89}\) 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 work as ‘components of regulatory ordering.’\(^\text{90}\) 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.\(^\text{91}\) Boer et al. have similarly shown how law is reproduced in the interactions of public and private actors in the transnational governance of the Mekong River Basin.\(^\text{92}\) 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.\(^\text{93}\) 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, e.g. financing, accreditation, and contracts.\(^\text{94}\)

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

\(^{87}\) Clarke, op cit  
\(^{88}\) Pellandini-Simányi and Vargha op cit  
\(^{89}\) 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. Hadfield, G. K. (2010). *Law for a flat world: legal infrastructure and the new economy*. USC Legal Studies Research Paper No 10-8  
\(^{90}\) Kingsbury, op cit.  
\(^{91}\) Eslava, op cit.  
\(^{93}\) Valverde, Johns and Raso, op cit  
\(^{94}\) Valverde, op cit
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 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, actor network analysis of international law, and global administrative law’s focus on transnational regulatory ordering. Cowan has shown how public infrastructures like railroads were integral for the assertion of jurisdiction to support colonialism, whilst Rodiles sees new but similar transformations taking place with China’s Belt Road Project, and Ojomo argues that transnational public works enable regional norm diffusion. Taking a more networked focus, Gordon’s work reveals how legal practice and public infrastructures reciprocally stabilize global time governance. Linking more explicitly to the themes prevalent in infrastructural studies drawn out above, Sullivan has analysed global security infrastructures as relational networks, and van Den Meerssche has explored the distributional impacts of AI governed migration control. 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.

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. Others argue that law itself is a component of infrastructures. Vice versa, it has been argued that infrastructures shape how law has developed and continues to operate, or that the relationship between law and infrastructure is co-constitutive. 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 sui generis form of infrastructure; one 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.

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96 Riles, op cit
97 See especially M Donaldson and B Kingsbury, ‘Ersatz Normativity or Public Law in Global Governance: The Hard Case of International Prescriptions for National Infrastructure Regulation’ (2013) 14(1) Chicago Journal of International Law 1
98 D Cowan, ‘Law as Infrastructure of Colonial Space: Sketches from Turtle Island’ (2023) 117 AJIL Unbound 5
99 Rodile, op cit.
101 Gordon, op cit
102 Sullivan, op cit
103 Van Den Meerssche op cit.
105 Eslava, op cit; Ojomo, op cit.
106 Gordon, op cit; Spijkerboer, op cit.
107 Kingsbury op cit
108 Gordon, op cit, Cowan, op cit
We now turn to unpack both arguments through an exposition of legal infrastructures as (a) socio-technical assemblages; (b) practical enactment; and (c) enabling normative change.

**Legal Infrastructures as social-technical formations**

A first entry point emphasizes how and with what effects legal infrastructures are materially mediated on the macro level and how then legal infrastructures shape society by assembling 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 networks110 and law is a material formation insofar as it retains ‘certain features that transcend time and space,’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 struggles113 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:116

> 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.

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 artefacts118, 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

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110 Ibid
111 Leonardi, op cit.
113 D Mathews and S Veitch, ‘The Limits of Critique and the Forces of Law’ (2017) 27(3) Law and Critique 349
117 Kang and Kendall, op cit
118 J Hoffman and R Joyce, International Law’s Objects (OUP, 2018)
119 See e.g. MB McKenna, ‘Designing for international law: The architecture of international organizations 1922–1952’ (2020) 34(1) Leiden Journal of International Law 1
121 McGee op cit
predominantly a linguistic phenomenon that links legality to objects and events through its ‘regime of enunciation,’ whereas for Pottage, law’s materiality arises when its ‘raw elements’ (texts, institutions, bodies, etc.) come together as ‘dispostifs;’ ‘assemblages [that] are made up of nothing other than what they assemble.’ 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.’ The perspective that one chooses to adopt will have different analytical consequences for cognizing what is law’s materiality. 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.

The concept of legal infrastructures offers further analytical traction on legal materialist scholarship by offering a fresh perspective on how law infrastructures society. 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. Infrastructure studies similarly recognizes this as infrastructure’s relational quality that arises infrastructures are ‘things, but also the relations between things,’ and further ‘doubly relational’ as their internal complexity recursively and symbiotically generates expansive capacities outwards. Law, in this vein, assembles the social world. Law arises from configurations of practices and materials that are structured but also structuring. 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. Suchman suggests we might think of law as like a bridge:

Like 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.

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. For Maisley international institutions circulate legal normativity through aesthetic and architectural forms, and Quiroga-Villamarín likewise contends that international conference halls

122 Latour op cit
123 Pottage op cit
124 Kang and Kendall, op cit.,
125 E.g., Bueger et al., ‘Ocean Infrastructures – Searching for a new vision for ocean politics,” in preparation.
126 This line of scholarship has notably been criticized for failing to properly account for law’s reflexivity, and vice-versa, sacrificing reflexive perspectives on law’s distributional tendencies, see respectively Pottage op cit and Hohmann op cit
127 Leonardi, op cit.
128 Larkin, op cit.
129 Harvey et al op cit.
131 Similarly, Bueger et al.
133 Cowan op cit
134 Maisely op cit
function as socio-technical spaces for world ordering. On a more general level, Kingsbury and Maisely’s theory of infrastructural publics proposes that law intervenes in technical, social and organizational worlds and they too become embedded in legality. Thus, at a general level, we can see how legal infrastructures are the result of interactions between humans and materials, but their ‘stabilized social and material relations’ rather than being ‘social’ or ‘material,’ they are ‘built environments’ that enable and constrain human interaction.

Thirdly, laws’ 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 the assemblage of devices [from court judgments to legal textbooks and routinized legal practices ‘whose interaction produce empirically observable consequences, that may, in turn, change the infrastructure itself.’ 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. Legal infrastructures are thus also characterised by their ability to structure processes of circulation. They circulate tangible assets, such as goods, persons, or capital, but also seemingly intangible things, like 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. Legal infrastructures play an active role in constituting or restraining power; they embody power, ‘route, block, challenge, or rework power in particular ways’ and also in this way create their own ‘infrastructural publics.’ 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 significantly obstructing mobility for others, thereby reproducing social stratifications. 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. In short, they connect people, ideas, and power through legal technologies of governing.

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135 D Quiroga-Villamarín, ‘Staging grounds: dialectics of the spectacular and the infrastructural in international conference-hosting’ (2023) 11(2) London Review of International Law 349
137 In other words, this element recognizes the ‘a recursive...shaping of abstract social concepts and the technical infrastructure, that includes technology’s materiality and people’s localized responses to it.’: Leonardi, op cit. K Caliskan, ‘Data money: The socio-technical infrastructure of cryptocurrency blockchains’ (2020) 49(4) Economy & Society, 540.
138 Kingsbury op cit
139 Of the distinction and Althusser, op cit.
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 need to be sustained by continued practices that bestows legality to them. As any other type of infrastructure, legal infrastructures need be maintained and repaired. A key entry point for studying legal infrastructures is thus how practices (re)produce normative connections and meaning relationships within and across regimes, jurisdictions and professional specializations and their respective practice communities.

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. However, a crucial benefit of legal infrastructure analysis is precisely its ability to de-center the inquiry, away from the more obvious legal categories, and to zoom out on broader constellations of law and policy. Such configurations can be seen, for instance, through traditional domains of socio-legal inquiry, as can be seen in e.g. Charlesworth’s call for an ‘international law of everyday life’ or Engle Merry’s work on ‘everyday understandings of the law.’ Apposite concepts such as ‘epistemic community,’ ‘interpretative community’ and ‘community of practice’ 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 (legal) normativity is organized and moves across formal regime 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,’ whilst socio-legal studies similarly casts practices as arranged by heuristics such as the pursuit of forms of capital or standards of competency or intersubjective values. Gordon’s recent analysis of the infrastructure of global time

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145 E.g., Graham and Thrift op cit.
147 On doctrine as a hermeneutical edifice of law see WH Byrne and HP Olsen, ‘Doctrinal Legal Science: A Science of its Own?’ (2024) Canadian Journal of Law and Jurisprudence
153 Star op cit
156 See e.g. J Brunnée and SJ Toope, *Legitimacy and Legality in International Law: An Interactional Account* (CUP 2010).
governance fits this mould 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.’157 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’158 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.159

A legal infrastructure may thirdly 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 discussed above, as its conception of the ‘material’ emphasizes the productive power of materiality.160 For some STS theorists, for example, practice is a ‘mangle’ because it weaves together social, technological, and natural elements, as a dialectic of ‘de-centred becoming.’161 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.162 John’s analysis of the digitization of international humanitarianism is instructive in showing how ‘legality “passes outside itself”’ and gets transmitted and shaped through a ‘great miscellany of practices and materials.’163

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 Gurthwith notes, in reference to Latour’s conception of the gas pipe quoted above:164

…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.

From this angle, legal infrastructures may be thought of as an ecology for legality, a ‘delicate balance of language and practice across communities’.165 An ecological understanding underlines that some elements of a network may be more jurisgenerative than others, serving to underscore law’s fundamental institutional groundings and characteristic hierarchies. For instance, as Star notes, ‘(s)study a city and neglect its sewers and power supplies (as many have),

157 Gordon, op cit.
158 Niewöhner op cit; Pellandini-Simányi and Vargha op cit.
162 Larkin op cit. see also Sullivan op cit.
165 Star and Ruhleder, op cit
and you miss essential aspects of distributional justice and planning power’. 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.

**Legal infrastructures and normative change**

Following on from the above, legal infrastructures may finally be thought of as enabling normative change. Here, an infrastructural perspective intervenes in debates on how law changes beyond formal mechanisms, such as treaty negotiations or legislative decisions. As infrastructures ‘mediate exchange over distance’, thinking infrastructurally about law directs our attention to how and with what distributional consequences legal norms, normative meaning, or argumentative techniques 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. 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.

Firstly, 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’. However, it is now generally recognized that much norm change at the international and transnational level 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, but also via legal interpretations adopted by states or international institutions. An infrastructural analysis brings attentions to the vehicles through

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166 Similarly, Star, op cit. notes
167 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. M Callon, ‘Techno-economic networks and irreversibility’ In J. Law (Ed.), A sociology of monsters: Essays on power, technology and domination (Routledge, 1991) 132
169 Edwards et al., op cit.
176 I Venzke, How Interpretation Makes International Law: On Semantic Change and Normative Twists (OUP 2012)
which such interpretations are mediated, such as transnational judicial dialogue\textsuperscript{177} or processes of soft law,\textsuperscript{178} 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 has 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.\textsuperscript{179} Far from being supported by state practice, the repeated interaction across regime boundaries may itself be seen as a driver of normative evolution.\textsuperscript{180} This then directs our attention to how legal norms, normative meaning, and legal arguments may flow through legal infrastructures, re-modulating them in the process.

An infrastructural analysis may moreover be directed to how representational practices, that is, practical understandings that constitute social meaning drive normative change. Anthropological\textsuperscript{181} and sociological theories\textsuperscript{182} 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.\textsuperscript{183} 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.’\textsuperscript{184} 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.\textsuperscript{185} Returning to the example of international refugee and human rights law above, the representational angle help 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.\textsuperscript{186}

Thirdly, a legal infrastructural analysis submits that law can change through non-representational practices, that is where meaning is constituted through relational qualities. Seen from this perspective, ‘agencies are [not conceived] as attributes but ongoing reconfigurations of the world,’\textsuperscript{187} as the social and material recursively ‘interlock’ to produce

\textsuperscript{177} See e.g. H Koh, ‘Transnational Legal Process’ (1996) 75 Nebraska Law Review 181
\textsuperscript{178} See e.g. J Pauwelyn et al., Informal International Lawmaking (2012), Oxford: Oxford University Press
\textsuperscript{181} Riles op cit.
\textsuperscript{183} I Venzke ‘Multidisciplinary Reflections on the Relationship between Professionals and The(ir) International Law’ ESIL 2013 5th Research Forum: International Law as a Profession Conference Paper No. 4/2013
\textsuperscript{184} Leonardi op cit
\textsuperscript{185} N Stappert, ‘Practice theory and change in international law: theorizing the development of legal meaning through the interpretive practices of international criminal courts’ (2023) 12(1) International Theory 33
\textsuperscript{186} T Gammeltoft-Hansen and MR Madsen, 'Regime Entanglement and Interstitial Legal Fields: The case of Denmark and the migration-human rights nexus,' (2021) 40 Nordiques 1
\textsuperscript{187} K Barad, ‘Posthumanist performativity: Toward an understanding of how matter comes to matter’ (2003) 28(3) Signs 801
new social and normative configurations. 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. On a more structural level, Pellandini-Simányi and Vargha similarly point to the dynamic interplay between markets and legal infrastructures. 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 inevitably drives 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.

3. Conclusion

In this paper, 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 studies, we have forwarded a concept of legal infrastructures as socio-technical platforms that mediate normative meaning 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 sui generis form of infrastructure 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 enable legal change. 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 foreground a more ‘internal’ perspective that take doctrinal configurations as enacted through legal practices as a starting point, a more macro perspective on legal infrastructures’ 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 regime

189 Sullivan op cit
190 Pellandini-Simányi and Vargha, op cit.
191 See also for instance, Byrne and Gammeltoft-Hansen, op cit.
fragmentation, dynamic interpretations by international courts or emerging transnational litigation networks. Here, thinking infrastructurally about law might entail tracing the 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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