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EDITORIAL

Embracing change in infrastructure landscapes

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ABSTRACT

Infrastructure constitutes a key perspective for the analysis of social change. At the same time, infrastructures exemplify the tension between dynamism and permanence. While they facilitate the constant movement of resource and capital flows, they are also characterised by a visible obduracy that makes them impervious to change.

This special issue examines how ideas of change and permanence have been explored in infrastructure studies. It focuses, especially, on the alternatives generated from a landscape perspective. Infrastructure landscape perspectives foreground the complex socio-technical and socio-ecological relations that situate infrastructures in specific conditions and locales. Infrastructure landscape perspectives enable analysis beyond utilitarian perspectives on infrastructure, revealing the range of emotional and cultural attachments that shape them.

KEYWORDS

Infrastructure landscapes; change; permanence; obduracy

Introduction: infrastructure and change

One of the most famous accounts of change in literature, Ovid's *Metamorphoses,* offers a journey through stories of individual transformation among the gods and heroes of the classical age. Most of Ovid's stories situate their subjects within an environment that eventually becomes part of their metamorphoses. Perhaps the most famous of those metamorphoses are Daphne's and Narcissus' transformations in their eponymous flowers. However, as the *Metamorphoses* reaches its final chapter in Book XV, the poem changes gear as Ovid turns to the teachings of the philosopher, Pythagoras. Ovid's Pythagoras (likely to be Ovid's invention based on other philosophers of the day, such as the Roman Philosopher Lucretius) brings the doctrine of change beyond the self as a necessary condition for existence, where permanence is only ever achieved in the same exercises of storytelling that attempt to describe it. Ovid recognises by the end that he aspires to immortality-itself a form of permanence- only via his own words. Still, Ovid's view of the world is one that sees change everywhere.

Ovid's Pythagoras says:

> Since I have embarked on the wide ocean and given full sails to the wind, I say there is nothing in the whole universe that persists. Everything flows and is formed as a fleeting image. Time itself also glides, in its continual motion, no differently than a river. For neither the river nor the swift hour can stop: but as wave impels wave, and as the prior wave is chased by the coming wave, and chases the one before, so time flees equally, and, equally, follows, and is always new. For what was before is left behind: and what was not comes to be: and each moment is renewed. (Ovid, 2004 [43 B. C-17 A. D. or 18 A. D]; Bk XV: 176–198)

If nothing in the universe actually persists, impressions of permanence are managed through the collective effort to find expression for that illusion of permanence. Only the flow itself

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perdures and solidifies any state of affairs, appearing immutable and impervious to human action. The unstoppable force of change prevents humans from transforming the world and approximating their fixed utopian ideals: it is change itself that fixes reality.

The question of change in human society can be addressed from different angles. Still, when it concerns the possibility of changing collective life projects, the question of change becomes enmeshed with humans' attempts to fix and arrange their collective life in space. Infrastructure is the central tool whereby humans accomplish that. Ovid's Pythagoras mocks humans' fear of death as an exercise in vanity. This is not dissimilar to the increasingly mocking attitude that has permeated infrastructure studies in recent years as they explore the vanity that permeates most infrastructural dreams of modern societies. The tension between dynamism and permanence results in resistance to change within the socio-technical arrangements that support life- what social theorist Anique Hommels called obduracy (Hommels, 2005). Obduracy is a product of infrastructures' embeddedness within the flux of human life. Still, it also relates to the specific frames that define those infrastructure systems and the compendium of practices that enable their reproduction (Hommels, 2005, 2008). Their embeddedness in a mesh of flows - knowledge and material flows-makes infrastructures 'stubborn' in their resistance to change. Sometimes this stubbornness results in the reproduction of unsustainable infrastructure models that become increasingly embedded in the urban fabric over time (Stanković, Dijk, & Hommels, 2021). More recently, however, there has been an increasing emphasis on understanding how structures of power and urban hierarchies influence not only urban change but also its permanence (Hommels, 2020).

Again, this reflection brings back the question of change to identify the locations of different forms of agency that can bring about such change. The recent interest in techno-politics, for example, 'makes visible the actors and organisations and past decisions that influence complex arrangements that perpetuate large-scale socio-technical systems in urban settings' (Foley & Miller, 2020, p. 315). Techno-politics is an analytical perspective that focuses on how strategic decisions shape the socio-technical assemblages that underpin inhabitation infrastructures, particularly attending to who is included and who is excluded in making those strategic decisions and with what consequences (Foley, Rushforth, Kalinowski, & Bennett, 2020). For example, in the city of Bengaluru (India), chronic congestion results from the combined effect of government 'super-bureaucrats,' mega-project developers and actors behind financial institutions that prioritise car circulation over non-motorized forms of transport that serve lower-income populations (Gopakumar, 2020). However, infrastructure is not only shaped by the actions of central actors involved in strategic decisions. And while analyses of the techno-politics of obduracy reveal the struggles of more powerful actors to maintain the status quo, there are less convincing on the activation of change (see some examples of thinking about the question of change in: Selin & Sadowski, 2015; Stanković et al., 2021).

Emphasising physical constraints to urban and infrastructural change, Kirkman (2009) develops Hommel's perspective to examine change possibilities not from the outside-in (i.e. how a socio-technical ensemble is built and maintained) but from the inside-out (i.e. what choices become apparent to a broader range of actors). Simultaneously, Kirkman proposes to move analytical attention away from central change makers (engineers, architects, planners) to focus instead on the wide range of individual agents that experience infrastructure change. When shifting this perspective, infrastructures and urban environments appear as both a process (dynamic) and as a product (static) (Kirkman, 2009). That tension limits the imagination of potential changes, complicates motivations, and poses limits to agency so that change is not only dependent on specific frames of analysis or professional practices but also depends on complicated moral choices, sometimes determined at the individual level and with no apparent relationship with an intended change.

In planning theory, ideas of obduracy have led to an interest in understanding socio-technical barriers to alternative urbanism models that approach urban form as the central technology

structuring urban space (Dotson, 2016). Challenging the idea that one can identify any natural progression in urban development, sustainable urbanism advocates have focussed on forms of flexible planning that combine the visionary aptitudes of top-down planning with the bottom-up efforts of incremental urbanism. Such a flexible combination of perspectives appeals to both a view from outside-in and from inside-out. The challenge emerges when engaging with the question of purposive change. Examining the question of obduracy with the promise of New Urbanism, Dotson (2016) writes:

> … incremental urbanism, if poorly organised and without appropriate expertise, can amount to what Lewis Mumford (as cited in Talen 2005, 110) derided as "aimless dynamism". That is, when lacking a strong normative vision and access to appropriate expertise, it risks never really making progress in addressing the barriers to more desirable neighborhoods. Relatively disempowered groups of laypeople are in many cases unlikely to be able to overcome obdurate infrastructure and entrenched sociotechnical practices.

Thus, there is a recognition that obduracy is itself the product of the operation of dominant, key techno-political actors who share frames and embedded practices but are also invested in the processes that enable their own recognition. However, at the same time, the need for visionary futures thinking becomes the alibi for the reproduction of modes of thinking that privilege reified expertise on the grounds that alternatives are unlikely to overcome sociotechnical barriers. Change is thus, again, dependent on grand visions of transition that are thus permeated with accounts of heroic action by visionary engineers and architects, reproducing the flaws of traditional science and technology studies.

Landscape thinking approaches infrastructure and obduracy from a different perspective, in line with Ovid's vision of a world in constant change. Rather than aimless dynamism, infrastructure landscapes result from a flow of change in which some actions become sedimented in the urban space. In contrast, others vanish in the fleeting moment in which they occur. The size of the act itself is not what determines the permanence of change as it becomes evident, for example, as we walk across cities where unfinished and unloved infrastructure projects intersect with precarious structures of inhabitation that resist both time and social prejudice. Sometimes, strategic projects of change transform the landscape and the politics that sustain urban inhabitation practices. Other times, strategic projects become subsumed under the ruins of previous grand dreams while seemingly spontaneous infrastructures perdure in the infrastructure landscape.

Infrastructure landscapes emphasise what Hommels (Hommels, 2005, 2008) refers to as the embeddedness of infrastructure in a socio-technical context but extend this notion by engaging with the connective tissue where such infrastructure is embedded (Castán Broto, 2019). Hommels' embeddedness emphasises the relational character of infrastructures, particularly the dimensions that make them functional throughout their life course. This may include material and technical elements, as well as institutional and financial constraints that direct the construction of infrastructure and the economic practices that justify their existence. However, infrastructure landscapes engage with two dimensions that are not well addressed in socio-technical analyses of infrastructure.

First, infrastructure landscapes do not restrict the perspective on infrastructure to the system that enables its functioning. Instead, they see it as embedded in a more comprehensive, not-always-functional matrix of elements alongside it. For example, a road is part of a socio-technical system that includes various elements such as land use planning, technological objects such as cars and trucks, regulatory codes for circulation, and cultural preferences for car-dependent mobility. However, the infrastructure landscape of the road extends to include anything from the dust of the road to the contingent nature of circulation and accidents. This realisation also highlights the multiple ecologies that shape infrastructure, including those involved in their decay and degradation and alternative engagements that happen around infrastructures in everyday life.

Second, infrastructure landscapes recognise the emotional affective dimensions of any engagement with the human surroundings. Infrastructures provide security and well-being, support economic and cultural worlds, create connections across space, and sustain symbolic values that ultimately structure social and political life. All those interactions, which do not always have a visible expression, constitute the possibilities for action and the translation of that action into a visible, permanent, tangible change.

A critique of these notions of infrastructure landscape is that they lack analytical value because they engage with everything and anything. Emphasising disconnection, heterogeneity, and contingency, infrastructure landscapes make it impossible to identify leverage points to create the purposeful, radical change many long for. Alternatively, a focus on infrastructure landscapes follows on from the insertion of processes of change in human actions whose consequences are only sometimes entirely predictable. This engagement with uncertainty is necessarily unsettling but also productive as it permits bracketing obsolete recipes to think about infrastructure and infrastructure futures. Unspoken politics, unexpected materialities, and unruly emotions constitute the connective tissue that generates infrastructure landscapes.

This special issue emerged from these concerns with politics, materialities, emotions and the specific conceptualisations of change that appear in analyses of infrastructure landscapes. The papers in the special issue were presented at an online workshop held in November 2020, and revised versions of those papers were submitted to the journal in early 2021. The papers engage with notions of infrastructure landscapes but open diverse conceptualisations about what change means in infrastructure landscapes. This collection also consolidates infrastructure landscapes as a salient theme for the journal *Landscape Research* whose concerns with ecologically sensitive and culturally rich landscapes will surely enrich the social sciences debates that the infrastructure turn has generated.

Bringing a landscape perspective into infrastructure studies

One of the critical contributions of this special issue is demonstrating the value of a landscape perspective to infrastructure and transition studies and consolidating this theme as an area of interest for the journal *Landscape Research*. Each contribution shows how the multi-dimensional approach opened by a landscape perspective is not only generative but also enables navigating some of the conundrums emerging in infrastructure studies.

In her contribution *Broadening the landscape of post-network cities: a call to research the off-grid infrastructure transitions of the non-poor*, Charlotte Lemanski (2021) applies a landscape perspective in the case of water management in Cape Town to understand the transformations in the off-grid city and how they affect both the poor and the middle classes. At the same time, the article makes significant theoretical contributions to understanding the concept of infrastructure landscapes. First, Lemanski explains how the notion of landscape has been ubiquitous in infrastructure studies, for example, in examining post-networked urban landscapes (Coutard & Rutherford, 2015) or landscapes of disaster (Gandy, 2008). At the same time, Lemanski notes how the combinatory suffix -scape is ubiquitous in urban studies scholarship, which often speaks of cityscapes, technoscapes, and infrascapes, generally denoting an opening of view that enables apprehending a broader perspective on the issues at hand. Lemanski explains that the seminar text Splintering Urbanism engaged with diverse infrastructure -scapes (water, ICT, energy …) (Graham & Marvin, 2002) (Indeed, the book dedicates a whole section to explain how infrastructure configurations reshape the urban landscape). Second, Lemanski advances some of the advantages of mobilising the concept of landscape (as opposed to alternatives such as assemblages, ensembles, or systems) as a means to engage with multi-disciplinary accounts of infrastructure and challenge received binary logics that currently limit theoretical development, such as divides between formal and informal infrastructures or rich and poor

experiences of infrastructure. The divide between temporary and permanent infrastructures is one of such binary logics called out by Lemanski, which invites us to rethink the concept of obduracy outlined above. Lemanski's analysis navigates between municipal politics and the decision spaces of everyday life to provide a multiscalar account of the off-grid city under water stress.

Kareem Buyana approaches 'landscape' as a methodological tool to develop the concept of 'transgression' in urban infrastructure. Within the study of electricity landscapes in Kampala, Uganda, Buyana argues that the mobilisation of a landscape perspective brings together the constituent elements of infrastructure, including 'cultural, historical, material, political, economic, social and environmental elements' (Buyana, 2022, p. 2). This is not an infrastructural salad of elements but rather a careful arrangement of the relations that maintain those infrastructures in the urban environment. In the case of Kampala, the constitution of an energy infrastructure landscape of orderliness produces a parallel one of resistance and transgression.

This is a different conception of infrastructure landscapes than the one offered by Daniel Muñoz, who sees infrastructure landscapes as performative. Muñoz builds upon the concept of Heterogeneous Infrastructure Configurations (Lawhon, Nilsson, Silver, Ernstson, & Lwasa, 2018) to explain that while infrastructures do indeed impact everyday life, everyday life is also profoundly implicated in the constitution and functioning of those infrastructures (Muñoz, 2021). In that sense, the landscape perspective is critical not because it offers a rich conceptualisation of infrastructure but because it enables focussing on what infrastructures do. In the case of Muñoz, the interest is on landscapes of accessibility 'as precarious arrangements that require constant involvement and relational work to exist in everyday life' (Muñoz, 2021, p. 2).

While Muñoz zooms in closely on everyday life interactions, Creighton Connolly expands the landscape perspective to analyse extended infrastructure landscapes. Rather than linking the landscape perspective to infrastructure studies, as Lemanski does, Connolly situates it within the tradition of political ecology (mainly urban political ecology where infrastructure debates have been most salient) through the concept of Landscape Political Ecology (LPE). For Connolly, LPE supports analytic strategies to situate infrastructure development processes within the contexts in which they take place, including 'the inter-connected social, ecological and political processes that are bound up with the transformation of urban space at multiple scales' (Connolly, 2022, p. 2). Landscape thus emerges as a hybrid concept whose power lies in its ability to transcend conceptual divisions between cultural and natural or urban and rural. In doing so, Connolly's account of extended landscape situates them closer to the realm of ecology than to technology.

Like Connolly, Carla de Laurentis (2022) also adopts an expansive, territorial perspective on infrastructure landscapes. However, this contribution comes from a different theoretical tradition on energy landscapes, which foregrounds the spatial aspects of the energy transitions, but is less concerned with broader multi-sectoral interactions (see, e.g. Calvert, Greer, & Maddison-MacFadyen, 2019). In this vein, de Laurentis adopts a landscape perspective as a means to 'stress how the spatial and material aspects of energy are considered important in influencing urban development processes and urban energy landscapes, becoming one of the prominent conceptual lenses to understand how energy provision and urban development co-evolve' (De Laurentis, 2022, p. 2). She does so, however, by expanding the notion of energy landscape to a regional perspective. Applying a regional perspective to energy landscapes follows the logic of thinking infrastructure through land and territory. For example, as de Laurentis explains, the regional outlook is ubiquitous in studies of water infrastructures and their ecological constraints, as the water basin has long been the unit of analysis for water management.

Justinien Tribillon (2022) titles his essay *Ways of seeing: landscape-infrastructure as critical design framework to analyse the production of Paris's Boulevard Périphérique* in a homage to the classical work of John Berger (2008). This year, Berger's influential documentary was featured in Tate Liverpool's exhibition *Radical Landscapes*, an exhibition which, while accepting landscape as a view, returned the power to the viewer and emphasised the multiple opportunities to

co-construct those landscapes. A similar spirit informs Tribillon's essay, which takes its cue from Gandy's preoccupation with the limited historical analysis of infrastructure studies, that for the most part weighs on normative and critical recommendations about how to intervene in landscapes (Gandy, 2011). As ways of viewing, infrastructure landscapes enact and reproduce political ideologies that cannot be reduced to a specific actors or actor's decisions but emerge from complex entanglements manifest in aesthetic viewings.

The final article in this special issue, written by the co-editors in collaboration with design engineer Timothy Whitehead, aims to counter the metaphorical use of the concept of landscape in transition studies by grounding it on the tradition of landscape thinking and the use of ideas of landscape in infrastructure studies and studies of energy landscapes (Castán Broto, Robin, & Whitehead, 2022). The term 'landscape' is used in transition studies just to refer to the exogenous factors over which the actors that operate within a given infrastructure or technological regime have no influence (for a well-known account see: Raven, Schot, & Berkhout, 2012). Castán Broto and colleagues put the concept of landscape to work to emphasise the mutual co-constitution of infrastructure and spatial change, in which a single regime is hardly to bound.

A landscape perspective opens the theme of infrastructure to re-examination across disciplines, challenges the binary oppositions that mire infrastructure studies, enables an emphasis on infrastructure as action and performance, foregrounds the territorial politics of spatial transformation and their co-evolution with cultural beliefs and aesthetic sensitivities, and, above all, offers a perspective of the co-evolution of societies and ecologies in space. A landscape perspective on infrastructure is rich and generative and opens multiple opportunities for transdisciplinary collaboration across different fields.

Rethinking notions of change in infrastructure landscapes

Change in infrastructure landscapes is approached in this collection both theoretically (how can we conceptualise and analyse change) and empirically (what agents of change can we identify in specific cases of infrastructure transformations). Lemanski starts the discussion of change as a hypothesis: a landscape perspective enables transcending binaries between change and permanence that shape inadequate conceptualisations of infrastructure. Indeed, while there are significant infrastructure transitions a posteriori, it is a lot more challenging to encounter analysis of transitions-in-the-making, where the direction of change can be identified (e.g., see Stankovic et al, 2021). Lemanski's account of the post-networked city again emphasises the heterogeneous infrastructure landscapes in which change happens within the tension between those decisions which are privatised, benefiting one individual (e.g. drilling a borehole) and those decisions that are collectivised, even when taken privately, such as the municipal decisions about establishing water restrictions. Reading Lemanski's analysis alongside discussions of techno-politics suggests that the binary distinction between private and public becomes fuzzy in the context of change.

While Lemaski questions not only how infrastructural change happens but also, whether we know when it counts as a change, in the transition sense, Buyana establishes specific strategies whereby citizens engage actively in the production of infrastructure landscape change. Buyana uses the notion of 'transgression' starting from two framings opened by the landscape perspective: '(1) transgression that stems from the ingenuities of actors, materials and networks beyond the purview of the state; and (2) transgression that arises from the politics of everyday struggles with state agents during the processes of experimenting, designing and implementation of energy infrastructure projects, through oversight from formal public institutions' (Buyana, 2022, p. 2). Transgression, he argues, is the logical result of the imposition of impossible forms of orderliness that overlook the needs of large tracks of the population but also exclude them from energy services.

Buyana's work stands in contrast with Muñoz's conceptualisation of change in infrastructure landscapes as a continuous process that constitutes the infrastructure itself- looking at infrastructure as a verb because it shows action rather than a precisely delimitated object or a given set of relations (see also: McFarlane & Silver, 2017). Looked at within landscapes where *infrastructuring* happens, Muñoz explains how accessibility is produced as the result of continuous, transformative work. The colourful vignettes that constitute the core of the empirical analysis demonstrate the granularity of those interactions in the relationship between everyday politics of accessibility and the continuous process of change that Muñoz observes in infrastructure landscapes.

Connolly focuses on large-scale infrastructure projects and their role in reconfiguring socio-ecological relations. Networked infrastructures and land transformations become the anchor points in which such forms of reconfiguration can be analysed through their territorial expression. However, those territorial expressions of change are unstable as they become, communicated, reappropriated and contested by different actors through the articulation of other discourses of infrastructure development and global integration. This notion of infrastructure landscapes foregrounds the material aspects of landscape change and how they condition what is perceived as a significant change in the territory.

The regional focus of de Laurentis shapes the conceptualisation of change in regional energy landscapes. On the one hand, the regional focus foregrounds the regional functional assemblages that enable territorial management, acknowledging 'the often-difficult relations between territorially bounded government bodies, with limited formal powers, and the steering of spatially-extensive infrastructures' (De Laurentis, 2022, p. 2). However, these governance structures work in spatially embedded settings, which again bridges Hommels' thinking on cities with the regional scale. De Laurentis' focus is on *territorial responsiveness*, that is, the contextual conditions and socio-material characteristics that condition change in energy landscapes at the regional scale. De Laurentis maps the attributes of such territorial responsiveness, including regulation and standards, spatial planning and land use, economic development and available development opportunities, regional infrastructure development, regional visions, regional autonomy, and infrastructure endowments.

Tribillon brings forwards a radical perspective on change focussed on the aesthetics of infrastructure landscapes and how different forms of representation and symbols constitute particular forms of ideology- that become visually salient in the case of the Boulevard Périphérique of Paris and the emergence of noise as a nuisance (Tribillon, 2022). Tribillon distinguishes between a diachronic and a synchronic study of change. A synchronic analysis, he argues, focuses on specific processes (design, retrofit, eradication) at a given moment. A diachronic analysis instead focuses on how particular instances of change unfold over different moments, sometimes over long periods, through which other social, cultural and material relations are established. The changing aesthetics of those ways of seeing are central to interpreting such instances of diachronic change. Hence, Tribillon situates architects and designers at the centre of infrastructure change.

Finally, Castán Broto and colleagues aim to identify the contingent and unexpected within strategic projects of infrastructure change. To do so, they distinguish three different elements of change in urban infrastructure: Change related to strategic actions that directly transform the landscape and technologies on it, such as large-scale infrastructure projects; change related to open-ended actions that people implement in daily life without the explicit intention to deliver infrastructure change, such as the improvised material arrangements whereby people access services when those are lacking; and change is related to the constant adjustments in urban infrastructure imaginaries to fit normative ideals to the realities of change. The result is that change in infrastructure landscapes appears rather unpredictable and combines a range of strategic and unexpected forms of agency.

Ovid's poem documents multiple forms of change among gods, humans, and the world, demonstrating that change is a feature of life in all its forms. At the same time key, fundamental

elements remain intact. The journal articles collected in this special issue demonstrate how a change in infrastructure landscapes takes place from the sphere of the mundane to the significant stages of regional change. Yet, some aspects of infrastructure landscapes- some essences- remain intact: their deeply political character, the embeddedness of social, cultural, material and affective elements, and the disconnect between normative narratives of action and the disorderly performances of everyday life. Infrastructure landscapes remain intact as manifestations of the complex socio-ecological relations that underpin infrastructures and how they translate into distinct political projects.

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