Infrastructure and health: laying down the big connections for well-being

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Humanity strives to and achieves progress through infrastructure. Infrastructure has become such a powerful force in our existence that our health and well-being are now, more than ever, dependent upon the infrastructures we imagine and build. This introductory article sets out what we are calling 'connections' between infrastructure and health that the journal and its authors will enable. By using 'connections', we emphasize the abstract here—epistemological, conceptual, ontological, paradigmatic—as ideas for future readers and contributors to build on, both in thought and in practice. In this piece, we first straddle disciplinary worlds and tensions to, hopefully, inspire future readers and authors. We then offer up some specific big connections for future scholarship.

INTRODUCTION: A BRIEF HISTORY OF INFRASTRUCTURE AND HEALTH, IN THE ANTHROPOCENE

The idea of infrastructure has taken hold in society dramatically since the late 1970s (see Fig. 1). The political popularity of neoliberalism follows a similar trajectory. Historically, of course, infrastructure and human development, both social and material, have been inextricably intertwined (Hitchner, 2012; Diamond, 2013). 'Public works' was the term that historically captured attention in emerging Western industrializing market economy nations (White, 2012) and the colonialism on which that emergence was built (Ramesh and Raveendranathan, 2020). When people think of infrastructure today, 'built things' come to mind, especially mobility hardware—road, rail, aviation, shipping hardware, digital networks—and the tools and mechanics associated with these. Given our interest in the connections between human and ecological health and infrastructure, we cast the net wider.

At the turn of the millennium, often in triumphant tones, some heralded the 21st century as 'the urban century'. Never before have so many earthlings dwelt in cities, a fact both celebrated and despised (Elmqvist et al., 2019). The turn of the millennium, unwarranted Y2K scares aside (Schaefer, 2004), did inspire a renewed global conscience. Since then, the end of history has not fared so well. We are, today, sitting on a powder keg of rising and massive inequalities, politically unstoppable heating of the climate, rampant populism and unsustainable population growth against a finite exploitive extraction industry base. Human and One Health are uniquely intertwined with this pivotal conflagration of challenges. Where social division, disruption and injustice happen, health falters. Progress stalls. Infrastructure, too, is both cause and consequence of human undertakings. Infrastructure-done-well, history tells us, is the key that unlocks progress.

## WHERE DO THE OPPORTUNITIES FOR CHANGE LIE?

The hopeful among us view the Sustainable Development Goals (SDGs) as a package to lift the planet towards better and more equitable futures (Marmot and Bell, 2018). Somehow, a reflection on resilience, (un)sustainability and the dire predictions of the Club of Rome in the late 1960s to early 1970s prompted many health scholars to formulate the notion of 'planetary health'—a perspective that recognized the intricately balanced nature of the planet, its ecosystems and the determinants of health of Gaia (Horton et al., 2014). Integral to this belief is the epoch of the 'Anthropocene', based on the observable evidence that for the first time since Terra cooled and started to allow for life forms, one particular variant of mammal is making permanent and indelible changes to the geophysics of the planet.

These major millennial milestones somehow all predicted and embraced the most dire of contemporary
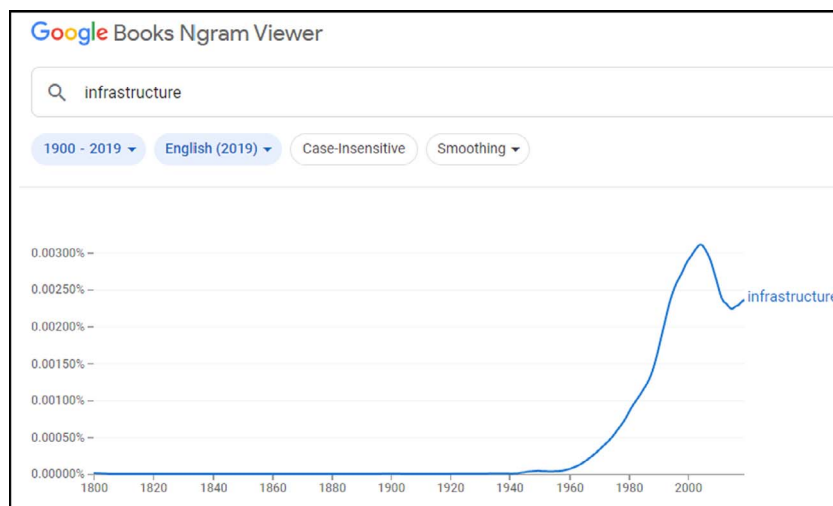
Figure 1. The occurrence of 'infrastructure' in English language world literature (via Google Ngram viewer)

challenges to sustainable life that we are facing in the 2020s—pandemic devastation and looming climate catastrophe. In nothing more, really, than acts of hope and faith, we sought to understand a new way of seeing a way out of cascading synergies of crises—or at least, to formulate concrete ways out of the confluences of the Big Wheels of the urban century, sustainable development, health equity, planetary health and the Anthropocene.

Ideas, then, matter. And action has been stymied by stubborn inability to connect across boundaries of knowledge and practice. The health SDG wants to connect with the Infrastructure SDG but the reality of disciplinary interests and resourcing undermines that intention (Harris et al., 2020b). But times are changing, sped on by the urgent expediency brought on by multiple crises that concern our planet—our home. The time is ripe to connect more and better with and across sectors and disciplines.

That intersection is where this journal, *Infrastructure and Health*, fits. We expect authors and audiences for the journal to be multi-disciplinary, if not inter- and transdisciplinary (Lawrence, 2015). We support sectoral expertise that will progress some of the knowledge we seek. But we also seek connections that will fill and bridge the gaps.

Accepting that humans are now terraformers (Pak, 2016), means generating the evidence, action, policy and governance required to shape a wiser, more charming, happier, equitable, thriving and sustainable planet—and beyond (de Leeuw, 2021). Rather than coining or reinventing grandiose terms (such as complexity science, implementation science, the science of delivery or even 'deliverology', knowledge translation) in *Infrastructure and Health*, we set out to formulate a common solution—perhaps paradigm—that would resonate across the realms of urbanism, climate change, sustainability, equity and health. 'Infrastructure' is the trans-planetary, joined up, pivotal phenomenon to making equitable human and ecological health flourish. This view is strongly affirmed at the highest levels of government and industry. The continued investments by China in the Belt and Road initiative, a trillion-dollar commitment to infrastructure in the USA and 300 billion European Union euros dedicated to climate conscious global infrastructure—in the 2020s so far alone!

THE ESSENTIALS BEHIND THE CONNECTIONS

To express that we are excited to be editors-in-chief of *Oxford Open Infrastructure & Health* is, predictably, an understatement. We have underscored the title with the subheading, 'big connections for wellbeing'. That tagline sums up our interests.

Humanity has arrived at a juncture where big connections matter. Ideas, fostered through significant liaisons between people and institutions, are needed to make progress towards well-being for all. In our view, infrastructure and health are the two fundamental 'big' concepts on which that progress will hinge.

To that end, in the rest of this introductory editorial, we articulate the fundamentals of both and the connections between them. The intent is to provide a foundation to readers and potential contributors at the outset of what we hope is a long and fruitful explication of the relationships between infrastructure and health.

We start with health then turn to infrastructure. Having laid out the big connections, we then outline the types of submissions we would like to see to initially progress the journal and its mission.

HEALTH

Most people frame and perceive health as 'health care' or the main mechanism by which 'health' is made obvious, the hospital. Think 'health and infrastructure' and images of the hospital precinct loom large for many. That framing is unhelpful and problematic. In a survey of

European Union health policy practitioners, for instance, there was consensus to avoid the 'H-word' (Health) if the aim was health and well-being (Howard and Gunther, 2012). The narrow frame about health is insufficient. In line with the challenges presented above, we prefer to see health as an individual, social and ecological resource. Health allows us to live better lives—more equitably, sustainably, intergenerationally and mindful of complex existences and interactions. Equity is a driving value for healthy and fulfilling lives. Taking action for health equity means a deep engagement with power (Harris et al., 2020a) to challenge and change politics for a just, diverse, intersectional planet.

In stating this, we continue to be inspired by the health definition of Rene Dubos (1959; Dubos, 1987) who defined health as 'the expression of the extent to which the individual and the social body maintain in readiness the resources required to meet the exigencies of the future.' The implications of such an emancipatory approach to the concept of health are significant (de Leeuw, 2017b). Rather than embracing a professionally determined deficit model, Dubos' view puts people and ecosystems at the centre of planetary health—incidentally, Dubos is also credited with coining the phrase 'Think Global, Act Local' (Gerlach, 1991). His position creates a more resilient, equitable and sustainable momentum for human and ecosystem health, well-being and longevity.

Broad views and positions on health were, in fact, the historical basis for the idea and practice of the field of Public Health—with infrastructure to provide sanitation and housing as means (Winslow, 1920; Acheson, 1990; Hamlin and Sidley, 1998; Szreter, 2005; Schultz, 2008; Szreter et al., 2016; de Leeuw, 2017a). For instance, among the classics, we also ground ourselves in Winslow's 1920 casting of the idea of *public health*: 'the science and art of preventing disease, prolonging life, and promoting mental and physical health and efficiency through the organized community efforts for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease and the development of social machinery to ensure to every individual a standard of living adequate for the maintenance of health, so organizing these benefits as to enable every citizen to realize his birthright of health and longevity' (Winslow, 1920). It does not require too much profound exegesis to understand that, by embracing these views, health necessarily is contextual, contestable and thus, above all, political.

Health, as a resource that varies over time, space and culture is profoundly conditioned by our environments, the things that humans create and the countervailing forces of Planet Terra (and beyond). That creation process may happen in a deliberate way, planned and with human purpose. Second, it may—and ought—also involve recognition of the intricate interlacing of existing and emerging built and natural environments.

This One Health perspective is gaining recognition and prominence in health and infrastructure thinking. And third, our health potential is impacted by (semi-) autonomous environmental and planetary processes, such as weather, tides, geophysics, ecosystems services (e.g. the combined living forests and oceans of the world), etc. These three ways of abstract salutogenesis—and we recognize the more direct sociology of this process as cast by Antonovsky (Lindström and Eriksson, 2006)—in our relation to our surroundings dictate a particular way of considering infrastructure, and its function in human and planetary development.

INFRASTRUCTURE

Infrastructure is a product created through praxis. Definitions of the practice of infrastructure tend to focus in on what it does and what it sets out to achieve (Harris et al., 2020b). Such a position is important but presupposes that infrastructure is deliberate, even agentic. Infrastructure nevertheless exists simultaneously separate from but connected to human action and interventions. Ecosystem services, for instance, are as much infrastructure as the anthropocentric, material, 'things' we humans build. Our actions, nevertheless, are transforming those forms of infrastructure as a triple-bottom-line event and entity: economically, ecologically and socially.

The bulk of the pertinent literature defines infrastructure as a facilitator of societal outcomes (Star, 1999; Larkin, 2013; Filion and Keil, 2017; Addie et al., 2020), although few engineers may have that ultimate outcome in mind in the creation process. A brief walkthrough from content to contestation will suffice.

Writing about the anthropology of infrastructure, for instance, Larkin situates infrastructure in space and commerce. Warning against the limits of defaulting to funding and building infrastructure projects '[i]nfrastructures' Larkin counters 'are built networks that facilitate the flow of goods, people or ideas and allow for their exchange over space. ... literally providing the undergirding of modern societies, and they generate the ambient environment for everyday life' (Larkin, 2013, p. 328). Using an ethnographic lens, Star (1999) sees infrastructure as 'both relational and ecological'. Star (1999) lays out how infrastructure embodies, and can be studied through, its design as much as its mix of 'transparent and opaque' paradoxes. Filion & Keil (2017) take an urban policy lens that lays down the contested nature of infrastructure in 'suburbs' globally. Of crucial note is their argument that by being embodied by tensions and difficulties, infrastructure shifts society towards innovation. Noting the 'infrastructure turn' [in urban politics at least (Dodson, 2017)] over the past 20 years, Addie et al. (2020) shift attention to how infrastructure, especially urban infrastructure, has been co-opted as 'spatial fixes' by neoliberal proponents of (re)structuring societal investments and subsequently

contested and politicized as either 'utopian imaginaries of smartness, efficiency, resilience … or dystopian fantasies of failure and collapse'. Sifting back through the archives of urban political economy scholarship, seminal thinkers from Arendt, to Harvey, Massey, Healey and Brenner have consistently taken square aim at infrastructurally created spatial inequities.

Infrastructure decisions result in health inequities by (adversely) influencing relations between people and places (Cummins et al., 2007; Bambra, 2016). In practice, just as Arendt, Harvey, Massey and others explained, taking a health equity lens to infrastructure requires meaningfully engaging with 'places' as local, social focussed, contested, messy and empowering. That relational understanding of infrastructure and place challenges decisions and processes when these are centralized, asset focus, apolitical, clear, disconnected (Corburn, 2017; Harris et al., 2022).

Most jurisdictions today have a legislated, societal or cultural position on infrastructure that splits its practice, funding and sectoral ambitions. One such dimension is the notion of 'hard' infrastructure that builds physical infrastructural investments. The other is 'soft' infrastructure, which 'maintains' services and societal standards. For sustainable progress, 'hard' and 'soft' infrastructure ought to intertwine. Political and regulatory preference intervenes to preference hard infrastructure, often on a project-by-project basis, largely governed by money and investment interests. Institutionally, then, the more powerful twin is the one with the money, conceived and built ostensibly for the betterment of economic growth. As a result, economic- or asset-driven infrastructure is always, without fail, the centre of political and policy decisions (Harris, 2022, in press).

But the public interest, developed over time and because of emerging intensity of disruptions to people's lives, requires attending to 'soft' infrastructure. Soft infrastructure is fundamental and profound for our health and well-being. We are social beings, influenced by our socio-ecological, as well as built, surroundings. The social infrastructure twin is less tangible, less politically powerful and connected, has less money and tends to sit at the back of policy institutions unnoticed while its alter ego takes the limelight. But social infrastructure is fundamental to the social fabric and services that most, if not all, societies have become tied to.

INFRASTRUCTURE AND HEALTH AS AN ACT OF CREATION OR RESPONSE

Before multiscalar city science and urban theory (Brenner, 2004) and the wondrous spatial big data gaze of Bettencourt (Bettencourt and West, 2010), there was the design-inspired theorist of settlement, Constantinos Doxiadis, and his 'ekistics' (Doxiadis, 1970). We take a leaf out of his pentagrammatic view of settlement and planetary evolution (Fig. 2). 'Infrastructure', in our view,
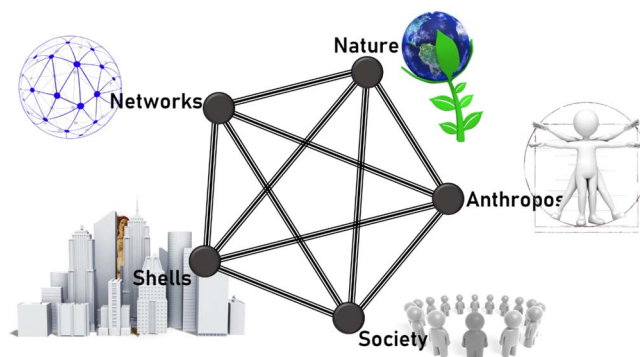

Figure 2. Doxiadis' heuristic of balanced settlements
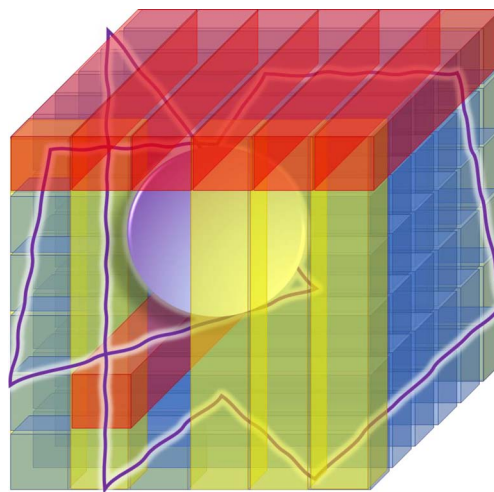

Figure 3. Health as one of—competing—dynamics at the interface of infrastructures, values and processes in society

plays out at the interface of the five dimensions of these, i.e. the human organism (Anthropos), society, nature, networks and shells. Specifically, the latter two are pertinent to our health related casting of infrastructure. Networks are the connections (public transport, roads, airwaves, mnemonic paths and metabletic consideration) and shells the built and natural protections and facilities we need to survive and thrive as a species and planet—homes, workplaces, markets, trains, planes and automobiles, etc.

This heuristic neatly frames our view, and the potential, of a discourse around broadly cast infrastructure and health as a resource and potential in an ecosystems perspective—going even beyond 'One Health' (e.g. Rock and Degeling, 2015). We propose a dynamic visualization of this new playground as a cube (Figs 3 and 4). Figure 3, and those with a static page view will need to imagine this, represents the concept of health as a dynamic within the elements of infrastructural thinking, planning, design and implementation. Sometimes in the infrastructure lifecycle health is at the core, whereas other times other competing issues take over. As a simple
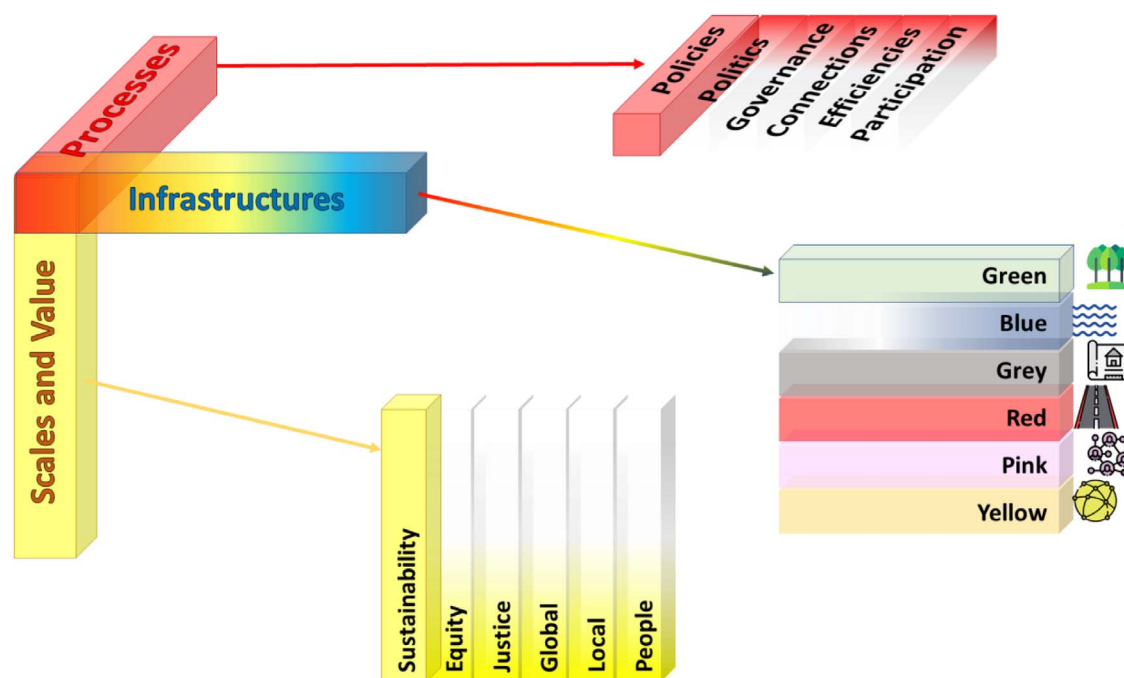
Figure 4. The three dimensions of infrastructure development

example, a digital network, at some point in its development, requires incorporating concerns about the equitable roll out and use of said network as a health enhancing piece of infrastructure (Schram et al., 2018). At other points in its development, such as the laying of the cable, health takes more of a backseat to engineering issues.

Figure 4 situates the infrastructure cube, and health within that, in a broader set of conditions. Infrastructure types help provide the boundaries for investment and delivery. Scales and values provide the depth and breadth—who funds, for what purpose, why and with what short- and long-term impacts. Processes bound the doing of infrastructure and whose voices are powerful or not. Economic efficiencies: will it cost? will it benefit? Weighed up against participation: who is it for? who benefits or is at risk?—for instance.

In this universe that we propose, 'health' is a key parameter. However, we would also be the first to recognize that health is but one issue/agenda in a competing public policy and industry environment. Economics is another, and self-realization a third. For instance, infrastructure throughout history has acquired geopolitical meaning not just as political collateral, but as a primary pursuit. This was as much truer for the Roman system of aqueducts (Hitchner, 2012) as it was for the 20th century political elevation of the discipline of economics (Carter, 2021). We invite our multitude of colleagues around the world who realize that health is a critical human–ecosystem factor in broader planetary development to share with us how they see these parameters play out.

We also observe that, following our above deconstruction of the functions and meanings of 'infrastructure', a classification and delineation may be both useful and ephemeral. For non-infrastructure specialists such as health policy makers and students, the mnemonic of colourful types of infrastructure (following traditional colours on maps) may be useful: *green infrastructure* is the natural and ecological world; *blue infrastructure* refers to both the marine environment and H_2O dependencies in any terrestrial context; *grey infrastructure* denotes the impromptu and/or designed 'shells' in Doxiadis' world view; *red infrastructure* comprises mobility and traffic, including shipping, road, rail and aviation as well as its associated systems; *pink infrastructure* extends to the various types of knowledge systems and their generation across and within cultures and time; and *yellow infrastructures* pertain to glocal networks of species (including humans), goods and services. At the same time, infrastructure focused communities (e.g. engineers, designers, maintenance, etc.) may well recognize that all of these are delicately intertwined and driven by the considerations on the other axes of the cube—and those within the health field concerned with determinants and distribution of health (equity) would instantly recognize these as drivers of (planetary) health and well-being, too.

CONNECTING FOR WELL-BEING

We hope that *Infrastructure and Health* can play a significant role in framing and crystalizing the discourse, the policy agenda and the practice and meaning of infrastructure and health. This is a vast agenda. We would be embracing a not insignificant volume of hubris if we would claim to know what this agenda, beyond its cubic contours in the above figures, will be. A few initial areas of scholarship and discovery (and indeed, policy and political need) would be the following.

- Health both as a result and the driver at the interface of various 'infrastructures': hard, economic, built; soft, social, services; sector-specific initiatives—transport, water, energy, digital, housing, health services, urban and regional planning, design, built environment, economics.
- Health and a socio-ecological framing of infrastructure: systems thinking, geography, justice, equity, ecosystems, transformation, sustainability, integration, cities and scales.
- Policy and politics behind infrastructure and health: political science, governance, partnerships and action.
- Technical aspects to infrastructure and health: measurement, paradigms, well-being, quality of life, economics, social science, environment, engineering, data, guidance, impact assessment and evaluation.
- Discussion and elucidation of intervention and governance agendas around infrastructure and health that claim, identify or disprove, patterns of exacerbating inequities (including, for instance, neo-colonialism, gender bias, funding distortion such as embezzlement and rorting, etc.).
- Novel methodologies and review efforts to connect: cost benefit plus, citizen science, big data, small artisan science, grids, computational data driving, interactive databases, deliberative democracy, co-production and co-design.
- Taking on power and progressing empowerment through health and infrastructural change: engagement, action research, institutions, indigeneity and colonialization, feminist, race, queer and intersectionality.

Clearly, like all the points in this introduction, there are further connections across this list—and invite exciting transdisciplinary collaborations. The ideas presented here, including the above considerations, are really just starting points for the journal in terms of breadth and depth. We look forward to tapping a rich vein of insight and scholarship. Over to you!

ACKNOWLEDGEMENTS

References

1. Acheson, D. (1990) 'Edwin Chadwick and the World We Live in', *The Lancet*, **336**: 1482–5.
2. Addie, J.-P. D., Glass, M. R., and Nelles, J. (2020) 'Regionalizing the Infrastructure Turn: a Research Agenda', *Regional Studies, Regional Science*, **7**: 10–26.
3. Bambra, C. (2016) *Health Divides: Where You Live can Kill You.* Bristol, UK: Policy Press.
4. Bettencourt, L., and West, G. (2010) 'A Unified Theory of Urban Living', *Nature*, **467**: 912–3.
5. Brenner, N. (2004) *New State Spaces: Urban Governance and the Rescaling of Statehood* Oxford University Press.
6. Carter, Z. D. (2021) *The Price of Peace: Money, Democracy, and the Life of John Maynard Keynes*. New York: Random House Trade Paperbacks.
7. Corburn, J. (2017) in 'Equitable and Healthy City Planning: towards Healthy Urban Governance in the Century of the City' *Healthy Cities*. pp. 31–41, New York, NY: Springer.
8. Cummins, S. et al. (2007) 'Understanding and Representing 'Place' in Health Research: a Relational Approach', *Social Science & Medicine*, **65**: 1825–38.
9. De Leeuw, E. (2021) in 'Interplanetary Health Equity: Implications of Dominant Value Systems in Space Exploration for Human Cultural Identity and Equitable Survival' *Project Earthrise: Proceedings of the Ninth Annual Conference of in vivo Planetary Health*, New York London: WW Norton & Co, vol. 18. p. 10654.
10. Diamond, J. (2013) *Guns, Germs and Steel: A Short History of Everybody for the Last 13,000 Years* Random House.
11. Dodson, J. (2017) 'The Global Infrastructure Turn and Urban Practice', *Urban Policy and Research*, **35**: 87–92.
12. Doxiadis, C. A. (1970) 'Ekistics, the Science of Human Settlements', *Science*, **170**: 393–404.
13. Dubos, R. J. (1987) *Mirage of Health: Utopias, Progress and Biological Change* New Brunswick, New Jersey: Rutgers University Press.
14. Elmqvist, T. et al. (2019) 'Sustainability and Resilience for Transformation in the Urban Century', *Nature Sustainability*, **2**: 267–73.
15. Filion, P., and Keil, R. (2017) 'Contested Infrastructures: Tension, Inequity and Innovation in the Global Suburb', *Urban Policy and Research*, **35**: 7–19.
16. Gerlach, L. P. (1991) 'Global Thinking, Local Acting', *Evaluation Review*, **15**: 120–48.
17. Hamlin, C., and Sidley, P. (1998) 'Revolutions in Public Health: 1848, and 1998?' *BMJ*, **317**: 587–91.
18. Harris, P. (2022) *Illuminating Policy for Health* Palgrave: Springer (Forthcoming 2022).
19. Harris, P. et al. (2020a) '"Stop Talking around Projects and Talk about Solutions": Positioning Health within Infrastructure Policy to Achieve the Sustainable Development Goals', *Health Policy*, **124**: 591–8.
20. Harris, P. et al. (2020b) 'A Glossary of Theories for Understanding Power and Policy for Health Equity', *Journal of Epidemiology and Community Health*, **74**: 548–52.
21. Harris, P. et al. (2022) 'City Deals and Health Equity in Sydney, Australia', *Geographia Medica*, **73**: 102711.
22. Hitchner, R. B. (2012) in 'Roads, Integration, Connectivity, and Economic Performance in the Roman Empire' Alcock, S. E., Bodel, J., and Talbert, R. J. A., (eds) *Highways, Byways, Road Systems in the Pre-Modern World*, vol. 5. p. 222, Chichester: Wiley.
23. Horton, R. et al. (2014) 'From Public to Planetary Health: a Manifesto', *The Lancet*, **383**: 847.
24. Howard, R., and Gunther, S. (2012) *Health in All Policies: An EU Literature Review 2006–2011 and Interview with Key Stakeholders*, Brussels.
25. Larkin, B. (2013) 'The Politics and Poetics of Infrastructure', *Annual Review of Anthropology*, **42**: 327–43.
26. de Leeuw, E. (2017a) in 'Cities and Health from the Neolithic to the Anthropocene' *Healthy Cities*. pp. 3–30, New York, NY: Springer.
27. de Leeuw, E. (2017b) in 'From Urban Projects to Healthy City Policies' *Healthy Cities: The Theory, Policy, and Practice of Value-Based Urban Planning*. pp. 407–37, New York, NY: Springer.

28. Lindström, B., and Eriksson, M. (2006) 'Contextualizing Saluto-genesis and Antonovsky in Public Health Development', *Health Promotion International*, **21**: 238–44.

29. Marmot, M., and Bell, R. (2018) 'The Sustainable Development Goals and Health Equity', *Epidemiology*, **29**: 5–7.

30. Pak, C. (2016) *Terraforming: Ecopolitical Transformations and Environmentalism in Science Fiction*Liverpool University Press.

31. Ramesh, A., and Raveendranathan, V. J. H. C. (2020) 'Infrastructure and Public Works in Colonial India: Towards a Conceptual History', *History Compass*, **18**: e12614.

32. Rock, M. J., and Degeling, C. (2015) 'Public Health Ethics and More-Than-Human Solidarity', *Social Science and Medicine*, **129**: 61–7.

33. Schaefer, N. A. (2004) 'Y2K as an Endtime Sign: Apocalypticism in America at the Fin-de-Millennium', *The Journal of Popular Culture*, **38**: 82–105.

34. Schram, A. et al. (2018) 'Digital Infrastructure as a Determinant of Health Equity: an Australian Case Study of the Implementation of the National Broadband Network', *Australian Journal of Public Administration*, **77**: 829–42.

35. Schultz, M. (2008) 'Rudolf Virchow', *Emerging Infectious Diseases*, **14**: 1480–1.

36. Star, S. L. (1999) 'The Ethnography of Infrastructure', *American Behavioral Scientist*, **43**: 377–91.

37. Szreter, S. ed (2005) *Health and Wealth*, Rochester: University of Rochester Press.

38. Szreter, S. et al. (2016) 'Health, Welfare, and the State—The Dangers of Forgetting History', *The Lancet*, **388**: 2734–5.

39. White, A. J. (2012) 'Infrastructure Policy: Lessons from American History', *The New Atlantis*, 3–31.

40. Winslow, C.-E. (1920) 'The Untilled Fields of Public Health', *Science*, **51**: 23–33.