Introduction: More-Than-Human Footprints

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More-Than-Human Footprints

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Abstract

This issue of *Footprint* explores specific spatialities and materialities found across those operational landscapes of primary production that constitute the metabolic basis of urbanisation. To the extent that these landscapes are increasingly automated and digitised, production and circulation practices are becoming more capital intensive and even less labour-intensive. While amplifying the precarity of human labour, this process relies on appropriating the work of more-than-human assemblages of machines, plants, animals and microorganisms. Central to the focus of this issue is understanding the way these processes are grounded in specific architectural and landscape configurations. In this way, we also aim to complement the debates on past issues of *Footprint*, offering an investigation of the impact of technological transformations beyond the concentrated landscapes of human inhabitation.

Keywords

more-than-human city, more-than-human work, operational landscapes, automated landscapes, situated knowledge

Endless covered fields of crops lit with yellow or pink LED light, dominated with sensors and automated control systems, devoid of human presence. These are the images of contemporary Dutch greenhouses for horticultural production that are increasingly used in the media to illustrate three emergent conditions: the future of food production, human obsolescence in automated work environments, and the architecture of the so-called Post-anthropocene.[1] Most of these accounts however, ignore the fundamental labour of largely invisible, but crucial agents: pollinators.

Crops grown indoors are out of the reach of wild pollinators, a fact that could certainly impact yield and the quality of fruits. Without pollinators, tomatoes, sweet peppers and eggplants risk suboptimal development. Handheld electric vibrators or air blowers have traditionally been employed in small operations, yet their use is too labour intensive (and expensive) for bigger concerns. Therefore, hives of *bombus lapidarius,* also known as the red-tailed bumblebee, have become ubiquitous in greenhouses across the Netherlands to pollinate crops. They have many advantages over other insect pollinators: they have better sight orientation, withstand colder temperatures, target pollen directly, are less aggressive than bees (that is, better colleagues to humans), and their use is less labour intensive, and therefore cheaper.[2]

However, the reign of the bumblebee in the greenhouse might be close to its end. The reason is not just the well-known widespread global decline of pollinators, but the possibility of perfecting pollination through technology. Research groups and start-ups alike are developing autonomous micro drones able to fly like insects and use airflow to vibrate flowers for contactless pollination. This is important, because bees and bumblebees may damage flower organs when landing on them in their search for pollen or nectar; they can potentially increase the risk of disease transmission, and have an uneven performance throughout the year. In addition, a drone's eyes can track crop status and offer insights on growth parameters to managers.[3] Nobody's job is safe these days.

More-than-human, more-than-city work

Greenhouses and plants; bumblebees and drones: shifting assemblages of controlled environments and more-than-human actors in search of technonatural utopias for efficient urban metabolisms.[4] They are assemblages that can be conceived as mirror images of smart city visions that dominated technofuturist debates at the turn of the century, and still continue to emerge as responses to 'sustainable', 'equitable' and 'resilient' forms of living.[5] The recent growing diffusion of AI applications has only amplified these trajectories, weaving together speculations around promises of the applications of big data and sensorial platforms in urbanism, with broader discussions around the impact of AI on the social and spatial division of labour. With cities being infrastructural constructs based on information, but also the core of information economies, they have naturally been at the centre of these debates.[6]

But as social and environmental tensions become increasingly interwoven in the wake of the accelerating climate crisis, it becomes apparent that the battlegrounds of our technological futures might not lie at the core of human settlements – which in any case cover no more than 3 per cent of the planetary terrain.[7] They could rather unfold across the multitude of more-than-city, and largely more-than-human landscapes that operationalise in direct and indirect ways more than the 'other' 70 per cent of the earth's land surface: the landscapes of agricultural production, resource extraction, circulation and waste disposal that support city life.[8] Over the past decade, debates around the state of planetary urbanisation, unfolding around the work of Neil Brenner and Christian Schmid, have emphasised the importance of understanding the more-than-city landscapes of extended urbanisation in a dialectical relationship with the familiar agglomeration landscapes of concentrated urbanisation.[9] Both are interwoven through the geo-metabolic interdependencies linked to the spatial division of labour suggested by urbanisation: the more people, capital and economic activities concentrate in large dense settlements, the more interdependent they become with the operationalisation of a multitude of landscapes that construct their metabolic basis, and the material basis of their economies. As this urban mode of geographical organisation becomes generalised, the pressure upon primary production landscapes intensifies, in a dual search for efficiency and profit characterising the capitalist mode of production, turning them more and more into specialised, capitalised operational landscapes.[10]

These operational landscapes of planetary urbanisation reflect not only a geo-metabolic spatial division of labour, but also a shifting socio-techno-natural division of labour. More-than-city landscapes are largely operationalised through the work of more-than-human agents: from plants, animals and microbes, to machines and biotechnological agents. Processes of primary production assemble bundles of (paid or unpaid) human labour with (unpaid) more-than-human labour. These articulations shift decisively through the implementation of technological means, often reflecting the exhausted capacity of natural systems to contribute 'free labour', or their inability to keep up with increases in productivity. Through these shifts, operational landscapes weave both capitalism and urbanisation into the 'web of life' of Jason Moore's *Capitalocene*.[11]

The story of the plausible gradual expulsion of the *bombus lapidarius* from Dutch greenhouse complexes reflects exactly such a shift in the composition of ecological surplus: the greenhouse itself reflects a mode of technological substitution of otherwise free gifts of nature (favourable climatic conditions for growing plants) through capitalisation, while the substitution of the (unpaid) work of the bumblebee with the automated drone swarms seemingly leaves only plants as the last frontier of appropriated natural work in the process of agricultural production.

Towards worldly concreteness

Yet, far from being Nature, even plants have a long history as a form of 'lively capital'.[12] To serve human needs both as workers and commodities, plants have seen their traits and metabolism constantly remade, by crossbreeding and biotechnology, and their productivity further enhanced through their interaction with assemblages of AI, sensors, processors, actuators and contingent human labour in automated landscapes of production.[13] Accounting for the partial stories of bumblebees or plants, and the tangled webs that connect the non-human to one another and with human beings, is an urgent necessity. The overwhelming complexity of the landscapes of planetary urbanisation shaped by capital and technoscience, and the unintended consequences of human actions within, have destabilised humanity's capacity to imagine ways to move forward in this age of polycrises. 'That things could be different is the impulse of speculative thinking', Maria Puig de la Bellacasa argues, yet, as Rosi Braidotti points out, encountering 'too-much-ness' may mark the limits of becoming – of the potential of things being otherwise.[14] Part of the problem may be the limitations of urban theory on planetary urbanisation in accounting for partial, minor perspectives. This follows on Donna Haraway's critique of technology of vision and perspectivism, the abstraction of global datasets and cartographic representations of the planetary risks falling into the 'fallacy of misplaced concreteness', or mistaking the abstraction for the thing.[15] Deterministic explanations and views from nowhere do the 'god trick' of providing an explanation, but background those minor, subaltern voices, vernacular histories, and instances of multi-species

co-creativity within operational and automated landscapes, hampering the possibility of alternative minor theories of planetary urbanisation.[16]

Pluralising objectivity by means of partial perspectives and situated knowledge, as proposed by feminist theory, ethnographic and anthropological approaches, becomes crucial for the productive disclosure of friction between the planetary and the situated.[17] Communities and social movements in the global hinterlands, particularly indigenous movements, have spearheaded a reckoning that lies at the root of anti-extractivist ontologies, epistemologies and theories, as many groups have consistently resisted exploitation, arguably since the sixteenth century. David Graeber and David Wengrow vindicated the indigenous critique and its profound contributions to the epistemes of Western science and knowledge, as well as its political systems.[18] In the same way, Arturo Escobar's inquiry into the indigenous pluriverse and the multiple ontologies and epistemologies that populate the planet opens perspectives towards the imagination of new design stories that could afford creative transformations towards regeneration and abundance in territories of extraction.[19]

In addition, discourses that reclaim the voices and agencies of the non-human show the potential of interdisciplinary cross-pollinations and the inclusion of other forms of knowing. Political ecologists, such as geographer Susanna Hecht, have sought to interweave the findings of the social and the natural sciences into a holistic understanding of the 'social life of forests' and other ecologies.[20] Geographer Anthony Bebbington has applied this theoretical framework to study the political ecologies of the subsoil, and discusses extractivism from the perspective of the underground.[21] Overall, reading the Anthropocene, or Capitalocene, or any other -ocene, as 'patchy' or 'feral', may help tell what otherwise would be terrible stories in a different way, in turn revealing pockets of design agency, prompting calls to action and unexpected forms of 'response-ability'.[22]

Situating operationalisation

This issue of *Footprint* explores specific spatialities and materialities found across those operational landscapes of primary production that constitute the metabolic basis of urbanisation. To the extent that these landscapes are increasingly automated and digitised, production and circulation practices are becoming more capital intensive and even less labour-intensive. While amplifying the precarity of human labour, this process relies on appropriating the work of more-than-human assemblages of machines, plants, animals and microorganisms. Central to the focus of this issue is understanding the way these processes are grounded in specific architectural and landscape configurations. In this way, we also aim to complement the debates on past issues of *Footprint*, offering an investigation of the impact of technological transformations beyond the concentrated landscapes of human inhabitation.[23]

Our intention was to uncover the spatialisation of complex assemblages through which human and more-than-human agents are becoming operationalised in the making of the world ecologies of the Capitalocene. This issue reveals the social, technical and ecological tensions behind their composition, and thus revisits, from the perspective of non-city landscapes, persistent questions of cyborg urbanisation, as posed by Matthew Gandy.[24] We explore situated interpretations, building upon ethnographic and anthropological approaches to interpret the Anthropocene. Seeking to reveal how planetary-scale technological systems and flows are entangled with place-specific histories and landscapes of more-than-human ecologies, and to debunk neocybernetic fantasies of closed systems and total control, we shed light on the multiscalar dimensions of urbanisation processes. Overall, we offer a set of provocations, and call the Global North to rethink sustainability from the perspective of the urgent changes that must take place within its economy, geography, culture, and political structure, as we call into question what Vandana Shiva calls the 'monocultures of the mind', in a system of Global Cannibalism, dominated by Economic Barbarism and its irrational efficiency of eroding productivities, which include Carbon Extractivism.[25]

The contributions to this issue can be organised around three themes: 1) histories of multiscalar processes of operationalisation, revealing how the unfolding in time of political and economic imperatives ends up producing landscapes of extended urbanisation, with a focus on resource extraction, energy and data; 2) situated entanglements of technology, questioning assemblages of human and more-than-human work within particular landscapes and architectures; and 3) design investigations into automated landscapes of extended urbanisation, deciphering their physical and material configurations through mapping and visualisation exercises, and speculating on alternative futures. Below we elaborate on each of these themes and on how the different authors address them.

Stories of operationalisation

Marina Otero Verzier's essay 'Compulsive Desires: On the Entangled Realities of Lithium Extraction and the Limitless Quest for Energy' mobilises the concept of the 'Cartesian enclosure' to highlight the conditions that enable the dispossession of communities around sites of extraction for the sake of fulfilling dreams of a so-called green energy transition. Amid conflicting interests and

contradictions in landscapes of green colonialism, Otero's is a call for finding a common ground for collective action and more-than-human solidarity towards imagining a future otherwise.

In the article 'Platforms and Palimpsests: Urban Landscapes of Data in Northern Virginia', Ali Fard critically questions readings of platforms that reinforce myths of immateriality and sustainability of the digital, and scholarship confining platform urbanism to the city. His proposition to examine the operational landscapes of data production and circulation is meant to disclose the relationship between data, technology and capitalist spatial production, and to move discussions about digital platforms beyond the metaphor of the cloud.

More-than-human workplaces
Inês Vieira Rodrigues presents the results of her ethnographic and field study of cattle farming in the Azores in 'Insular Cowscapes: Technologies of Ecological Restoration'. Her work describes the operationalisation of 'cowscapes' as part of a long project of attuning the island to planetary demands for efficiency, optimisation and specialisation. With mitigation and restoration technologies appearing as fixes to support economic growth, Vieira Rodrigues argues for alternative scenarios for a post-pasture archipelago.

In 'Plantation Technologies: More-Than-Human Histories of Operationalisation in the Palm Oil Production Territories of Johor State, Malaysia', Hans Hortig investigates agro-industrial production as a process of urbanisation. Through a series of more-than-human vignettes – involving palms, weevils and owls – this article highlights plantation agriculture as a technology for the extraction of both natural resources and human and nonhuman labour, and pleads for establishing regulatory authority.

In 'Subversive Submersives: The Unseen Urbanisation of the Southern Ocean', Charity Edwards proposes to re-present this oceanspace as a way to question its mainstream perception as a remote wilderness. Employing 'wet ontologies' as a framework, Edwards's cartographic and image-making explorations bring to the fore forms of operationalisation of the ocean – for scientific research, resource extraction and surveillance – as well as the agencies and work of the wet technological bodies within.

Transformative media
The conceptual and ecological impacts of human stewardship of the environment are the focus of a review article by Katerina Labrou and Christos Montsenigos entitled 'In the Garden of Anthropos: Conservation after Artificial Intelligence'. The essay mobilises the garden metaphor as an invitation to reassess the planet's ecosystems as places of attachment and exchange between humans and non-humans. Labrou and Montsenigos argue for the formulation of a spatialised ecological intelligence to address ecological challenges and foster a new conservation culture.

Alexandra Arènes and Axelle Grégoire's visual essay entitled 'Terra Forma Speculative Mapping: Paris Watershed and Underground Environment' challenges the appropriateness of current mapping techniques to understand and respond to the environmental crisis. The result of a collective effort that brought together actors and researchers concerned with the ground, their mapping work both reveals the thickness and interactions of the critical zone, and operates as a boundary object useful to identify contradictions in urban planning processes.

Finally, in 'Walk Under the Midnight Sun: Mapping Capsicum Ecologies', Fuzzy Earth and the BÜRO imaginaire curator's collective present an unrealised project for the Hungarian Pavilion at the Venice Biennale. Carpets, an architectural element with a long history as a medium for storytelling, are used to reveal origin stories, instances of global circulation, technological environments and architectural systems in food systems. Woven of stories and pattern, their work serves as the basis to speculate on possible future capsicum ecologies.

On human and more-than-human footprints
Interrogating the spatialities of human and more-than-human interdependencies in a dialectical manner necessarily challenges their relationship with inherited spatial binaries, such as the urban and rural, the city and the countryside.[26] At a first level, the city and other agglomeration zones appear to be dominated by the concentration of human agents, capital and infrastructure, while the more-than-city, 'rural' areas are characterised by the operationalisation of more-than-human, bio-geo-technical agents. But considering them as part of a dialectical process of concentrated and extended urbanisation, city and more-than-city landscapes, human and more-than-human agents are woven together through the geo-metabolic interdependencies of urbanisation. Agricultural technologies are often developed in the innovation hubs of 'creative' agglomeration zones; genetically modified foodstuffs are primarily consumed in densely populated settlements.[27]

At the same time, the need for sustaining dense urban populations puts immense pressure on primary productive landscapes, and in turn, the urge to keep operationalising them acts as a generator for technological and capital investment at urban cores.[28] As planetary urbanisation struggles to resolve these processes through the capitalist search for profit, generative relationships in the capitalist web of life are often transformed to destructive relationships

in webs of death.[29] Pollution, environmental degradation, human and more-than-human expulsion are also operating in a dialectical relationship of mutual destruction. The typical conception of urbanisation degrading natural ecosystems through land use transformation, pollution and biodiversity loss, is only one side of the coin; on the other, the parallel intensification and operationalisation of more-than-city landscapes reflects back to the deterioration of conditions of human social reproduction in urban centres through the degradation of their base metabolic elements.

Within this context, technoscientific solutions and efficient policy-making that aim for a balanced, sustainable and equitable development of social and natural systems are being put forward to resolve these tensions.[30] Their normalisation is clear in the accelerated diffusion of nature-based-solutions paradigms, and institutionalised through the formalisation of various development trajectories in the form of Green (New) Deal(s).[31] While epistemological debates around more-than-human ontologies have foregrounded questions of inclusivity and just collaboration of human and more-than-human systems, the general tendency towards 'designing with nature' that characterises contemporary green development paradigms largely reflects an instrumental approach to more-than-human forms of existence.[32]

In that sense, technological developments are presented as ways to enhance the capacities of natural systems, through AI and biotechnological applications, or to mitigate their exhaustion and degradation, for example through various geoengineering aspirations.[33] In this way, the diffusion of technoscientific solutions across the more-than-city, more-than-human world, can be also seen as a signal of exhaustion and collapse of ecological systems, of closing frontiers of cheap natures, as more-than-human work seems unable to keep up with the accelerated pace and intensification of their operationalisation driven by the urge for endless growth. Moreover, as the application of technoscientific principles of efficiency prevails across the more-than-city, more-than-human systems, it also reduces their generative potential to the absolute envelope of the planned solutions.[34]

In a risky parallelism, it could be argued that in the same way that the generative capacity of urban environments – à la Jane Jacobs – is fuelled by the positive externalities of unplanned interactions, the simplification of the complex human and more-than-human interactions across the more-than-city world through their efficient organisation and management robs them of their unplanned, generative capacities.[35] The perils of the Plantationocene are somehow a mirror image of the perils of the monofunctional modernist zoning.[36] And yet, from precision agriculture and mining to progressive visions of circularity, the assumption of efficiency through the efficient alignment and organisation of human and more-than-human work persists.

In any case, the question around the state and performance of the emerging techno-natures that will animate the more-than-city landscapes of the twenty-first century becomes a key component of any scenario foregrounding resource efficiency – from agroecological visions to capital intensive high-tech utopias. But as long as these approaches are prescribed within the capitalist web of life (and death), prospects of technological progress and landmark goals that suggest linear advancement need to be positioned within a largely non-linear vector.[37] The articulations of human and more-than-human systems, city and more-than-city landscapes reflect an endless dance of their shifting capitalisation and appropriation in search of their more profitable bundles.[38] The bumblebees that are threatened with being replaced by the automated drones in Dutch greenhouses may very well return under conditions that increase the costs of capitalisation, while the enclosed, automated nature of the greenhouse itself might be challenged under different energy or labour regimes.

Whether dynamic or static, visions for the future of the more-than-human, more-than-city worlds that will serve as the core of any sustainable and equitable form of multispecies inhabitation of the planet, are largely lacking in major forms of practice. As several of the authors in this issue suggest, the time has come to bring to the fore alternative ways of thinking the human and more-than-human footprints, bringing Epistemologies of the South, Indigenous Knowledge Systems, and more-than-human ecologies to the forefront of a search for pathways to design otherwise, by accessing other forms of knowledge not legible by Western, Euro-centric theories and methods.

Notes

1. Frank Viviano, 'How the Netherlands Feeds the World', *National Geographic*, September 2017, https://www.national-geographic.com/magazine/article/holland-agriculture-sustainable-farming; Liam Young, 'Neo-machine: Architecture Without People', *Architectural Design* 89, no. 1 (2019): 6–13, http://doi.org/10.1002/ad.2381.

2. Kevin van Kester, 'How Does Pollination in Greenhouses with Bumblebees Work?', Royal Brinkman website, 18 June 2021, https://royalbrinkman.com/knowledge-center/crop-protection-disinfection/pollination-greenhouses-bumblebees; Karli Petrovic, 'Using Bees in the Greenhouse for Natural Pollination', *Greenhouse Grower*, 2 April 2017, https://www.greenhousegrower.com/production/using-bees-in-the-greenhouse-for-natural-pollination/.

3. 'Polybee: There's a New Drone in Greenhouses, and It Isn't a Bumblebee', *Hortidaily*, 16 August 2021. https://www.hortidaily.com/article/9344598/

polybee-there-s-a-new-drone-in-greenhouses-and-it-isn-t-a-bumblebee/; Patrick Williams, 'The Drones Are Close: Unmanned Aerial Vehicles Have Their Coordinates Set on the Greenhouse Industry', *Gardencenter*, August 2018, https://www.gardencentermag.com/article/drones-for-greenhouse-pollination-pollinators/.

4. Damian White and Chris Wilbert, 'Introduction: Technonatural

5. Time-Spaces', *Science as Culture* 15, no. 2 (2006): 95–104, http://doi.org/10.1080/09505430600707921.

6. Over more than three decades, the growing literature on what can broadly be referred to as 'smart cities' has been exploring and speculating on the transformative effect of technological applications in city development, with the majority of studies suggesting a solutionist approach to core urban problems, from mobility to sustainability. Among the vast and diverse literature on the topic, see for an overview: Anthony M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (New York: WW Norton & Company, 2013); for a critical appraisal, see: Antoine Picon, *Smart Cities: A Spatialised Intelligence* (New York: John Wiley & Sons, 2015).

7. For recent reviews among the growing literature on cities and AI, see: Michael Batty, 'Artificial Intelligence and Smart Cities', *Environment and Planning B: Urban Analytics and City Science* 45, no. 1 (2018): 3–6; Zaheer Allam and Zaynah A. Dhunny, 'On Big Data, Artificial Intelligence and Smart Cities', *Cities* 89 (2019): 80–91.

8. The important and disproportionate role of cities in transforming the planetary environment beyond their footprint has been widely recognised, as reflected in the UN's recurring note that cities cover around 3 per cent of the earth's surface, yet account for 60–80 per cent of energy consumption and 75 per cent of carbon emissions, which underlines both the discussion on Sustainable Development Goals (SDGs), and the UN Habitat agenda. However, until recently, little attention has been paid on the role of more-than-human agents and the conditions across more-than-human environments constituting this 'external' domain beyond the 3 per cent. See, for example, the discussion about SDG 11 on the United Nations' Sustainable Development Goals website, https://www.un.org/sustainabledevelopment/cities/; more specifically on the energy and resource question, see the United Nations Energy Programme, *Cities: Investing in Energy and Resource Efficiency,* 2011. For an overview of global calculations and datasets of city and more-than-city landscapes of urbanisation, see: Nikos Katsikis, 'Visualizing the Planetary Urban', in *Doing Global Urban Research,* ed. John Harrison and Michael Hoyler (London: SAGE, 2018), 12–33.

9. Initially introduced by Henri Lefebvre in his *Urban Revolution*, the question of planetary urbanisation has seen a resurgence through the work of Neil Brenner, Christian Schmid and a growing body of literature around it. See: Henri Lefebvre, *The Urban after Revolution,* trans. Robert Bononno (Minneapolis:

University of Minnesota Press, 2003 [1970]). Core literature on the topic by Brenner and Schmid includes Neil Brenner and Christian Schmid, 'Towards a New Epistemology of the Urban?' *City* 19, no. 2–3 (2015): 151–82; Neil Brenner and Christian Schmid, 'Planetary Urbanization', in *Urban Constellations*, ed. Matthew Gandy (Berlin: Jovis, 2011), 10–13; Neil Brenner, *Implosions/Explosions: Towards a Study of Planetary Urbanization* (Berlin: Jovis, 2014); and Neil Brenner, 'Theses on Urbanization', *Public Culture* 25, no. 1 (2013): 85–114.

10. Neil Brenner and Nikos Katsikis, 'Operational Landscapes: Hinterlands of the Capitalocene' *Architectural Design* 90, no. 1 (2020): 22–31.

11. Jason W. Moore, *Capitalism in the Web of Life: Ecology and the Accumulation of Capital* (London: Verso Books, 2015).

12. Donna J. Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008), 46.

13. Susan Schrepfer and Philip Scranton, eds., *Industrializing Organisms: Introducing Evolutionary History* (New York: Routledge, 2003); Marion Ernwein, Franklin Ginn and James Palmer, eds., *The Work That Plants Do: Life, Labour and the Future of Vegetal Economies* (Bielefeld: transcript Verlag, 2021); Víctor Muñoz Sanz, 'Best Supporting Characters', in *Automated Landscapes*, ed. Merve Bedir et al. (Rotterdam: Het Nieuwe Instituut, 2023), 149–59.

14. Maria Puig de la Bellacasa, *Matters of Care: Speculative Ethics in More Than Human Worlds* (Minneapolis: University of Minnesota Press, 2017), 110; Rosi Braidotti, *Transpositions: On Nomadic Ethics* (Cambridge: Polity Press, 2006), 214.

15. Alfred North Whitehead (1948), as quoted in Donna J. Haraway, *Modest_Witness@Second_Millennium. FemaleMan_Meets_ OncoMouse: Feminism and Technoscience* (New York and London: Routledge, 1997), 146.

16. Donna J. Haraway, 'Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective', *Feminist Studies* 14, no. 3 (1988): 575–99, 584, http://doi.org/10.2307/3178066; Building on Deleuze and Guattari, Cindy Katz defines minor theory as that which accounts for the 'material conditions under which knowledge is produced and shared' and is 'streaked with the peculiar temporality and spatiality of everyday life' (p. 488) in contrast to totalising theories. Set in a relation and not in opposition with the major, the 'alternative subjectivities, spatialities, and temporalities' (p. 490) of the minor speak about impossibility, about provoking a 'line of escape' in the major toward doings things otherwise (p. 489). Cindy Katz, 'Towards Minor Theory', *Environment and Planning D: Society and Space* 14, no. 4 (1996): 487–99, http://doi.org/10.1068/d140487.

17. For more on the concept of friction, see: Anna Lowenhaupt Tsing, *Friction: An Ethnography of Global Connection* (Princeton: Princeton University Press, 2005).

18. David Graeber and David Wengrow, *The Dawn of Everything: A New History of Humanity* (London: Allen Lane, 2021).

19. Arturo Escobar, *Territories of Difference: Place, Movements, Life, Redes* (Durham, NC: Duke University Press, 2008); Arturo Escobar, *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds* (Durham, NC: Duke University Press, 2018).

20. Susanna B. Hecht, Kathleen D. Morrison and Christine Padoch, eds., *The Social Lives of Forests: Past, Present, and Future of Woodland Resurgence* (Chicago: University of Chicago Press, 2014).

21. Anthony Bebbington and Jeffrey Bury, eds., *Subterranean Struggles: New Dynamics of Mining, Oil, and Gas in Latin America* (Austin: University of Texas Press, 2013).

22. Anna Lowenhaupt Tsing, Andrew S. Mathews and Nils Bubandt, 'Patchy Anthropocene: Landscape Structure, Multispecies History, and the Retooling of Anthropology', *Current Anthropology* 60, supplement 20 (2019): 186–97, http://doi.org/10.1086/703391; Anna Lowenhaupt Tsing et al., eds., *Feral Atlas: The More-Than-Human Anthropocene* (Redwood City: Stanford University Press, 2021), http://doi.org/10.21627/2020fa. For Haraway, response-ability is about 'learning to be "polite" in responsible relation[ality]' when 'looking back at each other'. Haraway, *When Species Meet.*

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24. Matthew Gandy, 'Cyborg Urbanization: Complexity and Monstrosity in the Contemporary City', *International Journal of Urban and Regional Research* 29, no. 1 (2005): 26–49.

25. Vandana Shiva, *Monocultures of the Mind: Perspectives on Biodiversity and Biotechnology* (London: Zed Books, 1993); Haroldo de Campos, 'The Rule of Anthropophagy: Europe under the Sign of Devoration', in *Baroque New Worlds: Representation, Transculturation, Counterconquest*, ed. Lois Parkinson Zamora and Monika Kaup (Durham, NC: Duke University Press, 2010), 319–40; David S. Peña, *Economic Barbarism and Managerialism* (Westport, CT: Greenwood Press, 2001).

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28. Stephen G. Bunker and Paul S. Ciccantell, 'Generative Sectors and the New Historical Materialism: Economic Ascent and the Cumulatively Sequential Restructuring of the World Economy', *Studies in Comparative International Development* 37 (2003): 3–30.

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31. Billy Fleming, 'Design and the Green New Deal', *Places Journal* (April 2019), https://doi.org/10.22269/190416.

32. See, for example: Michael U. Hensel, 'The Rights to Ground: Integrating Human and Non-Human Perspectives in an Inclusive Approach to Sustainability', *Sustainable Development* 27, no. 2 (2019): 245–51.

33. See for example: Giles Thomson and Peter Newman, 'Geoengineering in the Anthropocene through Regenerative Urbanism', *Geosciences* 6, no. 4 (2016): 46.

34. For a critical interrogation of the ethical, social, and environmental implications of geoengineering see: Holly Jean Buck, *After Geoengineering: Climate Tragedy, Repair, and Restoration* (London: Verso Books, 2019); for a critical approach to geoengineering through speculative design, see the work of Design Earth: Rania Ghosn and El Hadi Jazairy, *The Planet After Geoengineering* (Barvelona: Actar Publishers, 2021).

35. Jane Jacobs, *The Economy of Cities* (London: Vintage, 2016 [1969]).

36. Donna J. Haraway, 'Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin', *Environmental Humanities* 6, no. 1 (2015): 159–65.

37. Ideas of linear progress and development are reflected in several climate action strategies that suggest specific timeframes for specific targets, such as carbon neutrality by 2030, 2040, 2050, and so on, seeming to imply the existence of a final state of accomplishment, of balanced socio-natural co-existence. See: Constanze Fetting, 'The European Green Deal', *ESDN report* 53 (2020).

38. Raj Patel and Jason W. Moore, *A History of the World in Seven Cheap Things: A Guide to Capitalism, Nature, and the Future of the Planet* (Oakland: University of California Press, 2017).

Biography

Víctor Muñoz Sanz is a Mexican-Spanish architect, urban designer, researcher and educator. He is currently assistant professor of urban design at TU Delft, where he conceptualises, leads and develops critical research on the architecture and urbanism of the past, present and future of work. His research looks at the interplay of the design of productive landscapes with technology and management, and aims to question the role of urban design in enabling new urban economies and inclusive forms of work. He is the co-editor of the books *Habitat: Ecology Thinking in Architecture* (2020), *Roadside Picnics: Encounters with the Uncanny* (2022), and *Automated Landscapes* (2023). Víctor qualified as an architect at the School of Architecture of Madrid (ETSAM, 2006), and holds a master's of architecture in urban design, with distinction, from Harvard University Graduate School of Design (2011), and a PhD cum laude in architecture from Universidad Politécnica de Madrid (2016).

Nikos Katsikis is an assistant professor of urban design at TU Delft. His work lies at the intersection of urbanisation theory, territorial design and geospatial analysis. Through his research he seeks to contribute to a geographical understanding of the socio-metabolic relations between cities and their operational landscapes: non-city landscapes of primary production, circulation and waste disposal that support urban life. He holds graduate degrees in architecture and spatial design from the National Technical University of Athens (2006, 2008) and a Doctor of Design from Harvard University Graduate School of Design (2016), where he also served on the editorial board of the *New Geographies* journal.