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ENGAGING COSMOTECHNICAL DIFFERENCE IN ARCHITECTURE AND URBANISM:
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Contents

Cosmotechnical Difference in Architecture and Urbanism

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Abstract
This issue of Footprint explores the intersection between architecture, technology and cosmology. It does so by examining the concept of 'cosmotechnics', as proposed by the philosopher Yuk Hui. Cosmotechnics – defined as 'the unification of the cosmic and moral order through technical activities' – proposes that technology is not a universal category but always exists in a co-productive relationship with a specific cosmology. While cosmotechnics has fomented new scholarship in philosophy, STS and cultural theory, its implications for architecture remain underexplored. Here, we introduce the concept of cosmotechnics, distinguish it from previous approaches to technology and cosmology, and outline its unique relevance to architectural discourse. In doing so, we present a core theme of the issue: technologies, cosmologies and architectures do not only influence one another, but are indeed inseparable, mutually constitutive, and conjoined in continual coevolution. Finally, we introduce the contributions that comprise the issue – a diverse set of explorations of the theoretical and practical intersections between cosmotechnics and architecture.

Keywords
Cosmotechnics, technology, cosmology, ontology, worlding

In 1938, the French anthropologist Claude Leví-Strauss journeyed from the city of Cuiabá, Mato Grosso, into the depths of the Brazilian interior. His destination was the village of Kejara, one of the last strongholds of indigenous Bororo culture. After a week's travel upstream on the Rio Vermelho, he found a society that few outsiders had encountered before, one which had sustained its beliefs, rituals and traditions in the face of the cultural devastation of South America's colonisation. Of all the things he observed at Kejara – from ceremonial festivals, dances, crafts and art forms – what especially struck him was the radial plan of the village. As he discovered, this organisational logic was anything but arbitrary. The axes of this circular plan divided Bororo society into a complex system of moieties, clans and classes, and demarcated 'an intricate network of privileges, traditions, hierarchical grades, rights and obligations', such as rules of inheritance and intermarriage. In this way, the village form helped to enact, reaffirm and remind the Bororo of an immensely complex system of social organisation and religious belief, organising their daily lives in accordance with a cosmic order. But Kejara's form was not merely a *reflection* of Bororo cosmology. Rather, this spatialisation was a crucial act, indispensable to integrating cosmic and social space into a unified and enduring whole. As Leví-Strauss observed, this organisation was so integral to their way of life, that Salesian missionaries quickly learned that the fastest way

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to convert the Bororo was to remove them from this radial arrangement and relocate them to new, linearly-planned settlements. Leví-Strauss's study of the Bororo offers just one example of a ubiquitous pattern – namely, a deep imbrication of cosmologies, technologies and architectures in the making and unmaking of worlds.[1]

This issue of *Footprint* explores the intersection between architecture, technology and cosmology. It does so by examining the concept of 'cosmotechnics', a term proposed by the philosopher Yuk Hui, which suggests an irreducible and dynamic union between cosmology and technology. Cosmotechnics proposes that technology is not a universal category but always exists in a co-productive relationship with a specific cosmology (that is, a particular model of cosmic order). Hui developed the framework of cosmotechnics in a series of essays and books, most notably his 2016 monograph *The Question Concerning Technology in China*.[2] The book responds to what Hui identifies as a cultural and philosophical crisis that emerged in the wake of modernity, resulting from the expansive imposition of Western technology, along with its cultural and metaphysical assumptions, upon diverse cultures as an assumed universal. Industrial modernity induced powerful material, economic, and environmental transformations. But more than this, it homogenised diverse cosmological relations into one that conforms to modern technology.[3] As Western technology was spread and taken up uncritically, it imported a number of profound but unspoken cosmological presuppositions about the nature of the universe, knowledge, time, and the place of humanity in the cosmos. The assumption and tacit acceptance of a universal notion of technics surreptitiously transposed Western metaphysics onto cultures with entirely different cosmological relationships to technology.

The ascent of Western cosmotechnics to the status of a global norm has produced a flattening of technological differences, erasing what Hui calls technodiversity. Technodiversity refers to the spectrum of technological relations that would emerge from a plurality of cosmologies – and which transcend the categories and relations inherent to Western concepts of nature, culture and technics. Not only does this erasure pose sovereignty and justice questions by reproducing forms of colonial domination, but it has been argued to be at the metaphysical root of planetary crises, including climate change and ecological destruction. As this issue will explore, architecture is deeply implicated in these processes. Cosmotechnics helps draw attention to how the epistemological and ontological assumptions embedded in technological practices are internalised, reproduced and legitimated through imposed processes of architectural modernisation and globalisation. This issue brings the discourses on architecture and cosmotechnics together in order to uncover possibilities for mutual enrichment. How can the notion of cosmotechnics help a dominantly Eurocentric architectural discourse confront and address questions of technological and cosmological diversity? And how might the field of architecture, through all of its political, economic, social and environmental entanglements, help to develop the abstract framework of cosmotechnics in practical and concrete ways?[4]

From cosmology to cosmotechnics

The word 'cosmology' derives from the ancient Greek *kosmos*, meaning 'the world or universe as an ordered and harmonious system'.[5] Cosmology, then, is the study and explanation of that system of universal order. Broadly speaking, cosmology refers to understandings of the universe, including ideas about its structure, its constituent elements, and the relations between its parts.[6] In any given culture, these ideas permeate the language, symbols and practices of everyday life, and are not necessarily explicated in theoretical terms. Cosmologies provide the taken-for-granted assumptions that underlie shared understandings of reality. They delineate the boundaries of what is conceivable and thinkable and provide the framework for how humans make sense of and act in the world.[7] According to the historian N.D. Jewson, 'cosmologies prescribe the visible and the invisible, the imaginable and the inconceivable.'[8] More than mere descriptions of reality, cosmologies are inherently political forces.[9] Cosmological ideas are woven into powerful narratives about the natural order, which are drawn upon to legitimate certain actions as righteous and just, while casting others as unthinkable or repugnant.[10]

Cosmotechnics, on the other hand, is defined by Hui as 'the unification of the cosmic and moral order through technical activities'.[11] The implications of this formulation are significant: not only do cosmological ideas enable and constrain technological practices, but techniques and practices are the necessary means by which cosmologies are manifested and sustained (or negated). This leads to Hui's radical proposition that there is no technology, nor cosmology as such, 'only multiple cosmotechnics'.[12] The cosmos, in this sense, is less the outer space of astral physics, but rather the space of different lifeworlds constituted locally through shared places, myths and practices.[13]

By connecting cosmotechnics to the field of architecture, this issue aims to expand the ways in which technology is understood in architectural discourse. This understanding has evolved under the influence of the major twentieth-century thinkers in the philosophy of technology and in science and technology studies (STS). Architectural theorists of the early twentieth century such as Lewis Mumford and Siegfried Giedion developed a view of technology as an

ostensibly autonomous and deterministic force in society. Over the course of that century, a tradition of technological critique, beginning with the work of Martin Heidegger and developed by thinkers such as Herbert Marcuse, Jacques Ellul, Ursula Franklin, Albert Borgmann, Ivan Illich and Jürgen Habermas, would give rise to a sense that technology was acquiring a power and logic of its own, and was a force that threatened and oppressed human culture.[14] By the late twentieth century, a more nuanced view had emerged, which highlighted how technology was shaped by a complex set of cultural and social forces.[15] These ideas continue to exert a lasting influence over architectural and urban critique. Cosmotechnics builds on these approaches further still, by emphasising the need to understand this complex interaction in terms of the local cosmological contexts in which they emerge and evolve.

By identifying the co-productive relationship between cosmology and technology, Hui builds on a specific tradition in the philosophy of technology, one which has had comparatively little influence in architectural theory.[16] This tradition, associated with Gilbert Simondon and Bernard Stiegler, emphasises the integral role of technics in the process of hominisation. Simondon, one of Hui's primary influences, posited a complex, recursive, coevolutionary relation between tools, users and environments – a relation he called 'technicity'.[17] Bernard Stiegler extended this inquiry by showing how technical objects serve as mediums of collective memory, and are thus fundamental to the constitution of human psychology and subjectivity. In this view, technics is not merely something that humans *do*.[18] Instead, humans and technologies come to be what they are through a contingent and indeterminate process of reciprocal transformation.[19] That is to say, humans do not only evolve *with* tools, but *through* them.[20] As Hui argues in this issue, cosmotechnics is a framework for articulating multiple accounts of the *genesis* of technicities, by giving attention to the various religious, aesthetic, philosophical spheres in which tool-user relations originate.

Uniting cosmotechnics and architectural discourse presents a theoretical challenge, one that stems largely from architecture's ambiguous relation to 'technical practices' as invoked in Hui's definition of cosmotechnics. On the one hand, we cannot simply reduce architecture to a type of technology – as Roi Salgueiro Barrio and Sasha McKinlay argue in their essay 'The Sea Wall and the *Kampung'*, the layers of cultural, aesthetic, philosophical motivation that inform architecture exceed mere technological rationality. At the same time, architecture is inseparable from the technical objects and practices through which it is expressed. Whether in artefacts (such as buildings) or processes (such as design, construction, or knowledge production), architecture's ubiquitous and unavoidable interconnection with technics offers fruitful ground for analysis, as well as renewed practices and methods.[21] What is clear is that the complex, relational view suggested by cosmotechnics presents a timely and necessary evolution of the conceptual grammar by which architecture has hitherto understood technology. By foregrounding the irreducible relationship between the cosmological, the architectural, and the technological, cosmotechnics opens up a richer framework to explore this coevolutionary triad.[22]

Architecture, technology and naturalism: beyond the ontological and postcolonial turns

While an implicit recognition of the link between architectures, cosmologies and technologies has occasionally surfaced in architectural discourse, their interconnection has never been robustly theorised.[23] For example, theorists of the modern movement such as Siegfried Giedion and Walter Benjamin registered cosmological implications in the technologies of the new architecture.[24] Giedion clearly recognised the role of worldview, or what he called the 'orientation of the period'. In *Mechanization Takes Command*, he claims that:

> tools and objects are outgrowths of fundamental attitudes to the world. These attitudes set the course followed by thought and action. Every problem, every picture, every invention, is founded on a specific attitude, without which it would never have come into being.[25]

However, as one of the most active proponents of the modern movement, Giedion was less curious about the reverse process – what is the role of tools in transforming those very attitudes? More recently, Alberto Pérez-Gómez has argued that the Copernican Revolution produced a crisis of meaning which continues to define modern architecture.[26] His work shows how, through a cosmological transformation in the status of number and geometry, architecture turned away from experience, symbolism and poetry as its primary sources of meaning, and was increasingly subordinated to the imperatives of technology and mathematical certainty. For Pérez-Gómez, it was a cosmological shift that transformed architecture in the image of technology – a fate from which architecture must be rescued by reasserting the primacy of human subjectivity over technological rationality. Lewis Mumford – perhaps the most prolific writer to unite the discourses of technology and architecture – maintained a persistent connection to cosmology in his work, appearing most vividly in his invocation of mechanical and organic metaphors.[27] Culture, as well as its connection to nature, was a central preoccupation for Mumford. And while he extended his analyses to other civilisations and epochs, the basic ontological categories

by which he did so went largely unquestioned.

While these thinkers intuited a link between cosmology, technology and architecture, they shared some common shortcomings. In particular, they never confronted the prospect of cosmological plurality, nor did they question the assumed universality of Western cosmological ideas. The most significant of these ideas is the ontology of naturalism, one of the central pillars of Western cosmology since the Renaissance, which rests on an opposition between culture (the dominant) and nature (the subordinated).[28] By limiting their analyses to the Western experience, and taking for granted the naturalistic distinction between nature and culture (with technology seen as a cultural product), these thinkers failed to capture the full complexity of this triadic relationship. In some cases, technology was treated simply as subordinate to culture and ideas. In others, technology was seen as an overwhelming and inevitable force of social and cultural transformation. In either case, with technology neatly enfolded within the category of culture, a broader view of how cosmology and technology interact within architecture was never fully recognised.

Outside the Western architectural tradition, cosmotechnics also challenges and extends discourses in philosophy and the humanities that have given cosmological plurality more serious attention. Two of the most significant among these are the related discourses of the so-called ontological turn, and postcolonial theory.[29] The ontological turn is a movement that emerged within cultural anthropology in the 1990s, and takes as its starting point a rejection of the pretensions to universality of the aforementioned dualism of Western naturalism.[30] The turn toward ontology marks a move away from social constructivism or crude forms of relativism, which, in their superficial assimilation of diversity and multiculturalism, nonetheless proceed from unquestioned cosmological premises, such as a shared, unitary and stable 'nature'.[31] The ontological turn thus goes beyond epistemological pluralism by relativising the very entities and processes that are held to constitute 'reality'.[32] This ethos is captured in Andrew Pickering's proposal to 'take different worlds seriously', rather than explain away differences between diverse lifeworlds as the expressions of malleable cultures toward a singular and enduring nature.[33] While Hui affirms and extends the ontological turn's critique of the idea of a unitary nature, he also warns against the possible interpretation that this justifies a return to pre- or non-modern ways of life, or what Clive Hamilton terms 'going native ontologically'.[34] For Hui, the purpose of technodiversity is not to advance certain cosmologies at the expense of others, but to draw numerous cosmotechnics into a creative synthesis capable of addressing planetary crises.[35]

The second discourse that broaches the notion of cosmological plurality, which cosmotechnics extends, is postcolonial theory. Unlike the ontological turn, postcolonial theory has produced distinct and well-articulated bodies of research in spatial discourses. One such body of work exists in architectural history, where theorists have articulated the multifaceted and nuanced role that architecture plays in colonial and postcolonial domination. This literature places architecture within an extended conceptualisation of the modes of colonial power that include knowledge, culture and aesthetics.[36] The histories mapped by Jiat-Hwee Chang, Arindam Dutta and others have shown how architecture – not only as a technical artefact, but as a set of procedures, norms and institutions – acts as a vehicle of ideological and epistemic power, and has helped to assert Western worldviews, values and interests over those of the Global South.[37] Within the field of urban studies, postcolonial approaches have emphasised how the underlying epistemology of urban theory has been derived from the Euro-American experience.[38] The assumed universality of this epistemology, and its uncritical transferral to other contexts, it is argued, has not only led to a misinterpretation of the urban realities of the Global South, but underwrites a continuation of colonial era domination and capital accumulation through 'mainstream global urbanism'.[39] In response, postcolonial urban studies have sought to denaturalise the Eurocentric assumptions embedded in urban theory, draw attention to the unique specificity of cities and urbanisation processes beyond the West, and call for 'new geographies of theory' to emerge from the Global South.[40]

Both the ontological turn and postcolonial theory are united in their emphasis on the condition of *locality* in planetary politics, something that constitutes both a strength and a weakness. The challenge that these discourses made to Euro-American hegemony was a necessary correction to the long-presumed universality of Western ideals, and the forms of violence it enabled. More than simply calling for tolerance or recognition of the local against the global, these discourses stressed the active role that diverse, non-Western cosmologies must play in generating new knowledge, practices and politics. At the same time, a number of critiques have been made against these discourses. Hui has argued that postcolonial theory has tended to overemphasise historical narrative at the expense of technology's material agency. For him, even if the dominant narrative of Western naturalism is challenged and 'provincialised', the processes of modernity continue apace through the effects of material technologies that continue to influence design over time.[41] The invocation of a local-global dichotomy has also drawn criticism. For example, Hui has argued that the transformative potential of the local is foreclosed by its framing as an aesthetic counterpoint

to the global, as non-modern and non-Western culture is commodified in the service of global capital.[42] Moreover, as he claims in our interview with him, cosmological locality has often been conflated with ethnic or national identity. This overlooks the much more profound role of cosmology in orienting human action, and instead encourages social fragmentation – a retreat into identity that precludes possibilities for coalition and collective action.

An analogous critique has been made of postcolonial urban studies: that it may too quickly relinquish useful and necessary conceptual tools to describe the planetary dynamics that inevitably condition local contexts.[43] The broader financial, environmental and political conditions of the capitalist world system (what Neil Brenner, Jamie Peck and Nik Theodore call 'the context of contexts') are not a mere neutral container, but a productive force from which localities can never be wholly disentangled.[44] Cosmotechnics offers a way through this impasse by calling for renewed attention to locality, while acknowledging its insufficiency as an end goal and emphasising the dialectical, coproductive relationship between the local and global.

Cosmotechnics suggests both a historical and futural orientation. What Hui terms a 'new world history', in which the various technological cultures are no longer held to originate in Western *technē*, also forms the basis upon which alternative technological futures can be articulated. These futures exceed commonplace notions of technological innovation, referring to a more fundamental reinvention of tools and methods in ways that transcend the categories and relations inherent to Western cosmology. More work is needed, however, to define, operationalise and understand the ways that architecture and cosmotechnics interconnect. To that end, the contributions to this issue present a diverse series of explorations of the theoretical and practical intersections between cosmotechnics and architecture. They do so by foregrounding a productive tension between the local and universal dimensions of technology, within the situated contexts of various cultures. In so doing the contributions in this issue highlight the problems and possibilities of cosmotechnics as a project of reinvention.

Cosmotechnics as reinvention: problems and possibilities within and beyond architecture

The contributions begin with Maryia Rusak's essay titled 'Celestial Resistance', which explores the cosmotechnical conflict that emerged in the implementation of an ambitious building scheme for dozens of schools in Zambia, funded by the World Bank and assisted by a network of Norwegian agencies and consultancies. During the 1960s and '70s, this project sought to deploy a number of Western technologies, such as prefabricated construction and digital management systems, which clashed with local norms, processes and values. The essay illustrates how conflicts in cosmological visions often produce more than mere disagreement: two divergent cosmologies, each freighting their own assumptions about reality and truth, may be entirely illegible, incoherent, or even invisible to one another.[45] While cosmotechnical conflict ultimately undermined this modernist vision, it simultaneously reveals sites for reinvention.

Roi Barrio and Sasha McKinlay highlight similar geopolitical dynamics, but bring the discussion to the urgent environmental crises of the present day. Their essay examines two contrasting responses to the threat of rising sea levels in Indonesia, namely an enormous protective sea-wall, planned by Dutch firms, and the reflexive, adaptive modes of dwelling contained in the architectural, cultural and religious traditions of the *kampung*. As the authors explain, these divergent cosmotechnics should not be understood as zero-sum, but rather represent an opportunity to generate new approaches that integrate the global with the local. By foregrounding architecture's place within (and its power to reshape) the 'techno-geographic milieu', the authors suggest how cosmotechnics might aid architecture in overcoming the impasse facing 'cosmopolitical design'.

Experimental studio Diseño Detonante and Aura Cruz Aburto continue the theme of environmental disaster with a visual essay that explores the possibility of reasserting indigenous cosmotechnics in the face of the twin destructions of natural disaster and colonial dispossession. Based on the authors' time spent with the Binnizá and Ikoots people in the Isthmus of Tehuantepec in Oaxaca, Mexico, the essay chronicles their experiences following a devastating earthquake in September 2017, which destroyed the homes of the local people. While the rebuilding that followed was driven by necessity, it also presented an opportunity to re-establish ancestral ways of living and knowing, thereby reaffirming the connections between places, community and territory, which are continually threatened by modernist ideologies of progress and development.

Simon Sadler picks up the topic of indigenous ontologies in his review of Alison Page and Paul Memmot's book *Design: Building on Country*. The book aims to connect Australia's indigenous past to the current challenges of postcolonial modernity, through an exploration of the objects, spirituality, camps, shelters and materials of indigenous 'design' (a largely untranslatable term in indigenous Australian languages). For Sadler, the book presents 'an Aboriginal cosmotechnics' that, after 65 000 years of evolution, has been effaced by colonial domination. Taking Aboriginal ontologies seriously – including the socio-spatial relations, obligations to land, and forms of

kinship embedded within the indigenous notion of 'Country' – offers an opportunity to reframe future-oriented questions about design in a postcolonial Australia.

In a review of a collection of essays by the Japanese architect and theorist Hiroshi Hara, titled 'Space: from function to modality', Masamichi Tamura provides a glimpse into an early precursor to cosmotechnical criticism developed during the 1970s and 1980s. The essay reveals how Hara's thinking on space, modernity, tradition, technics and architecture prefigured the cosmotechnical line of inquiry. For example, Hara's concept of modality (which bears certain parallels to Simondon's technicity) refers to the 'material and locational contingencies' of architecture as technology, which cohere into integrated, complex environments, linking humans, tools and space.

Alan Díaz Alva reviews Anselm Jappe's 2020 book *Béton: Arme de construction massive du capitalisme*, which chronicles the rise of reinforced concrete as the construction material of choice of global capitalism. The essay shifts the focus from sites and populations towards materials, as well as the political, economic and social systems in which they're embedded. In particular, Alva argues that the pursuit of technodiversity requires that we grasp the specific local mechanisms through which such a monoculture was established in the first place. To that end, Alva highlights the unique value of the tradition of Marxist theory to which Jappe belongs, known as *Wertkritik*, which emphasises questions of matter and abstraction, rather than class or ideology.

Supplementing these essays, each of which grapples with a specific case and history, are a set of contributions confronting the methodological value that architecture might gain from the framework of cosmotechnics. Joel Letkemann considers methodological cues that a project of architectural cosmotechnics might take from the literary genre of speculative fiction (SF) and the concept of 'co-futures'. The argument centres on the work of physicist and science fiction author Vanadana Singh, whose work foregrounds alternative technological imaginaries that resist the universal, while maintaining a planetary-scale awareness through speculative infrastructures and technologies of social coordination. Beyond the ideas and imaginaries embodied in the final product of Singh's stories, the essay also considers the value that architecture might draw from the participatory strategies of their production – what Letkemann terms 'technologies of collaboration' – by which Singh draws diverse perspectives into her writing and worlding process. Casting architecture as its own narrative and story-building tradition, the essay points to ways in which the discipline's notions of futurity, time and progress might be reconfigured through other modalities of practice.

Robert Gorny's review essay grapples with the complex relation between cartographic practices (mapping) and the project of architectural worlding by inviting readers to rethink how worlding practices are implicated within the various technical processes of architecture. His review builds on work that connects worlding theories to the field of cartography, and attempts to map material transformations in parallel with the worlding practices that have emerged from post-humanist critical theory. Gorny considers the possibilities that such an approach offers for placing architecture within a general history of *technē*. This, in turn, could enable cartographic practices to perform their role as critical devices within contemporary technological decision-making.

The role of technological imagination in planetary crises is taken up further by Simon Weir as he explores the notion of tragedy, both as an artistic and philosophical category, and as a description of our civilisational predicament. Drawing on the traditions of surrealism and object-oriented ontology, the essay prompts a new consideration of the epistemological value of the non-rational. Striking AI-generated visuals draw on Magritte's 'tragic pairs', using the text prompts 'shipwreck' and 'theatre' to produce a creative scrambling of relations and non-relations, posing questions about the ontological stability of architecture. These scenes project into an alien future in which the aims of today's technology are ancient history, lying in preserved ruins. As the essay tours these otherworldly landscapes of 'cosmotechnical tragedy', readers are prompted to irrational interpretation, and to speculate upon radically redrawn architecture-ecology relationships.

Finally, we turn to the interview with Yuk Hui that closes the issue, in which he offers his own foray into a cosmotechnical view of architectural and urban questions. In a wide-ranging discussion, Hui expands on topics touched only briefly in his work to date, but which are immensely important for spatial and design disciplines. The first of these is the now ubiquitous notion of the smart city and the role of digital technologies in urbanism. Hui connects the smart city's promise of an automated, organic part-whole relation in urban space to the rising role of infrastructure and the geopolitical imperatives of competition. As smart city critiques appear to have run aground, having had little impact in slowing that particular urban ideology, Hui's suggestion to rethink analytical and critical methods is well overdue. The second pertains to geography and notions of space, particularly the role of regions and landscapes as vessels of transcendent and symbolic meaning. Hui traces Simondon's thoughts on this subject to Mircea Eliade's work in the history of religion, which describes an original union between humans and sacred spaces.[46] These places - constellated by

points and fields charged with cosmological meaning - represent counterpoints to the abstract, inert and homogeneous space of modernity. It is within this richer figurative and physical 'ground', Hui argues, that we must place cybernetic technologies.

The field of architecture is one of the primary arenas in which the global stakes of technodiversity will play out. Whether we see further technical convergence and homogenisation, or new proliferation of alternative modes of technological thought, spatial disciplines will figure centrally in this future. Despite the recent interest in cosmotechnics, further work is needed which seeks to define, operationalise and understand the link between cosmological ideas, technology and architecture. While the contributions to this issue have initiated this discussion, they also reveal new directions for further research. For example, how can modern societies overcome the political barriers to translating diverse cosmotechnics into new paradigms of spatial practice and urban theory? How does the massive acceleration in AI complicate the pursuit of technodiversity in architecture? How are global scale infrastructure projects implicated in cosmotechnical transformation? Which unwritten architectural histories might extend or challenge the theory of cosmotechnics? As this issue makes clear, a continued exploration of cosmotechnics and architecture is both timely and necessary.

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Notes

1. A rich body of historical and anthropological literature attests to the link between spatial practices and cosmological ideas. See Claude Lévi-Strauss, *Tristes Tropiques*, trans. John Weightman and Doreen Weightman (London: Penguin Books, 2011); Stanley Jeyaraja Tambiah, 'The Galactic Polity in Southeast Asia', *HAU: Journal of Ethnographic Theory* 3, no. 3 (December 2013): 503–34; Michael Herzfeld, 'Shaping Cultural Space: Reflections on the Politics and Cosmology of Urbanism', in *Life Among Urban Planners: Practice, Professionalism, and Expertise in the Making of the City*, ed. Jennifer Mack and Michael Herzfeld (Philadelphia: University of Pennsylvania Press, 2020); Émile Durkheim and Marcel Mauss, *Primitive Classification*, trans. Rodney Needham (Chicago: University of Chicago Press, 1967); for a close study of cosmological ideas in early Western spatial practices, as well as a brief account of parallels in African and Eastern traditions, see Joseph Rykwert, *The Idea of a Town: The Anthropology of Urban Form in Rome, Italy and the Ancient World* (London: Faber and Faber, 2010). See also the work of John Tresch on 'cosmograms' (images and symbols of the cosmos, such as in buildings, images and narratives), which surveys numerous architectural expressions of cosmological ideas; John Tresch, 'Cosmogram', in *Cosmograms*, ed. Mélik Ohanian and Jean-Christophe Royoux (New York: Lukas & Sternberg, 2005); John Tresch, 'Technological World-Pictures: Cosmic Things and Cosmograms', *Isis* 98, no. 1 (March 2007): 84–99.
2. Yuk Hui, *The Question Concerning Technology in China: An Essay in Cosmotechnics* (Falmouth: Urbanomic, 2016); Yuk Hui, 'On Cosmotechnics: For a Renewed Relation between Technology and Nature in the Anthropocene', *Techné: Research in Philosophy and Technology* 21, no. 2 (2017): 319–41; Yuk Hui, 'For a Planetary Thinking', *e-flux* 114 (December 2020), https://www.e-flux.com/journal/114/366703/for-a-planetary-thinking/.
3. Hui, 'On Cosmotechnics', 8.
4. Vinícius Portella, 'Cosmotechnics and the Multicultural Trap', *Triple Ampersand Journal (&&&),* 21 November 2022, https://tripleampersand.org/cosmotechnics-and-the-multicultural-trap/.
5. Anna Maria Destro, 'Cosmology and Mythology', in *21st Century Anthropology: A Reference Handbook*, ed. H. James Birx (London: Sage, 2010), 227; for a history of the term and its meaning in theological and scientific contexts, see Helge Kragh, *Conceptions of Cosmos: From Myths to the Accelerating Universe: A History of Cosmology* (Oxford: Oxford University Press, 2013).
6. Signe Howell, 'Cosmology', in *The Routledge Encyclopedia of Social and Cultural Anthropology*, ed. Alan Barnard and Jonathan Spencer (London: Routledge, 2010), 196–99.

7. Sociologists such as Douglas, Berger and Luckmann have shown how human action draws its meaning from a shared universe of symbols, assumptions and taken-for-granted beliefs. See Mary Douglas, *How Institutions Think* (Syracuse: Syracuse University Press, 1986); Peter L. Berger and Thomas Luckmann, *The Social Construction of Reality: A Treatise in the Sociology of Knowledge* (New York: Anchor Books, 1990).
8. N. D. Jewson, 'The Disappearance of the Sick-Man from Medical Cosmology, 1770–1870', *Sociology* 10, no. 2 (May 1976): 225–44.
9. Allan has shown that cosmologies have been a powerful force in the history of international politics, by constraining and enabling new ideas about meaningful, just, and valid purposes. Bentley Allan, *Scientific Cosmology and International Orders* (Cambridge: Cambridge University Press, 2017).
10. Cosmologies can be understood as constellations of cosmological elements. Allan proposes five categories of cosmological elements: ontology (the fundamental units of matter, the forces that govern them, and categories of representation), episteme (the modes and procedures likely to produce reliable or true knowledge of the universe), temporality (the nature and direction of time), cosmogony (the origins and history of the universe), and destiny (the role or place of humanity in the cosmos). Ibid., 11.
11. Hui, *The Question Concerning Technology in China*, 19.
12. Yuk Hui, 'Cosmotechnics as Cosmopolitics', *e-flux* 86 (November 2017), https://www.e-flux.com/journal/86/161887/cosmotechnics-as-cosmopolitics/.
13. Yuk Hui, *Art and Cosmotechnics* (Minneapolis: University of Minnesota Press, 2020), 41.
14. William W. Braham, Jonathan A. Hale and John Stanislav Sadar, eds., *Rethinking Technology: A Reader in Architectural Theory* (London: Routledge, 2007), xiv; Alan Jacobs, 'From Tech Critique to Ways of Living', *The New Atlantis,* Winter 2021, https://www.thenewatlantis.com/publications/from-tech-critique-to-ways-of-living.
15. Braham, Hale, and Sadar, *Rethinking Technology*, xiv.
16. Stavros Kousoulas, *Architectural Technicities: A Foray into Larval Space* (London: Routledge, 2023). Recent exceptions include: Robert Gorny, Stavros Kousoulas, Dulmini Perera, Andrej Rodman, ed., *The Space of Technicity: Theorising Social, Technical and Environmental Entanglements* (Delft: TU Delft OPEN, 2024).
17. On the notion of technicity in relation to architecture and technological change, see Dulmini Perera and Stavros Kousoulas, eds., 'All Is in Formation: Architecture, Cybernetics, Ecology', *Footprint* 28 (June 2021).
18. We follow previous issues of *Footprint* which have distinguished 'technics' as the 'general domain of technical practice as a system', as opposed 'technology', implying a fusion of technics with scientific rationality. Robert. A Gorny and Andrej Radman, eds., 'The Epiphylogenetic Turn and Architecture: In (Tertiary) Memory of Stiegler', *Footprint* 30 (July 2022).
19. This adapts the biological concept of 'ontogenesis' to a description of the tool-user relation.
20. Gorny and Radman, 'The Epiphylogenetic Turn'.
21. On the processual and artifactual modalities of technics in architecture, see Zeynep Çelik Alexander and John May, eds., *Design Technics: Archaeologies of Architectural Practice* (Minneapolis: University of Minnesota Press, 2019).
22. Gorny et al., *The Space of Technicity*.
23. A number of studies have examined the cosmological basis of architecture and urbanism without explicitly theorising the technological dimension: A.F. Wright, 'The Cosmology of the Chinese City', in *The City in Late Imperial China*, ed. G. William Skinner and Hugh D. R. Baker (Stanford: Stanford University Press, 1977), 33–75; Tilo Schabert, 'The Cosmology of the Architecture of Cities', *Diogenes* 39, no. 156 (December 1991): 1–31; Samer Akkach, *Cosmology and Architecture in Premodern Islam: An Architectural Reading of Mystical Ideas* (Albany: State University of New York Press, 2005). See also work that has mapped the influence of scientific cosmology upon urban theory: Graeme Davison, 'The City as a Natural System', in *The Pursuit of Urban History*, ed. Derek Fraser and Anthony Sutcliffe (London: Edward Arnold, 1983); Christopher Hamlin, 'The City as a Chemical System? The Chemist as Urban Environmental Professional in France and Britain, 1780–1880', *Journal of Urban History* 33, no. 5 (July 2007): 702–28.
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26. Alberto Pérez-Gómez, *Architecture and the Crisis of*

Modern Science (Cambridge, MA: MIT Press, 1985).

27. Lewis Mumford, *The Myth of the Machine: Technics and Human Development* (New York: Harcourt, Brace, Jovanovich, 1970); Lewis Mumford, *Technics and Civilization* (New York: Harcourt, Brace and Company, 1934).
28. Clarence J. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley: University of California Press, 1976).
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31. For example, De Castro has shown that the experience and concept of nature in Amerindian animist cosmology is based on a shared culture between humans and non-humans (that is, monoculturalism), counterposed by multiple natures (multinaturalism); Eduardo Viveiros De Castro, 'Cosmological Deixis and Amerindian Perspectivism', *The Journal of the Royal Anthropological Institute* 4, no. 3 (September 1998): 469–88. Phillipe Descola, by proposing a set of 'modes of identification' and 'modes of relation', attempts to account for the vast historical and geocultural diversity in cosmologies; Philippe Descola, *Beyond Nature and Culture*, trans. Janet Lloyd (Chicago: University of Chicago Press, 2014).
32. Holbraad and Pedersen, *The Ontological Turn*, 3.
33. Andrew Pickering, 'The Ontological Turn: Taking Different Worlds Seriously', *Social Analysis* 61, no. 2 (2017): 134–150.
34. Clive Hamilton, *Defiant Earth: The Fate of Humans in the Anthropocene* (Cambridge: Polity, 2017), 106.
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Biography

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Celestial Resistance: Norwegian World Bank Education Project in Zambia

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Abstract
This essay investigates the application of cosmotechnics in architecture through a case study of a large international construction venture, the Zambia World Bank Education Project. Financed in 1969 by the World Bank together with the Norwegian Agency for International Development (Norad), the project envisioned the construction of sixty-five new secondary schools in under four years. A Norwegian consultancy company hired for the project proposed a modular semi-industrial building system and a computer-aided system of process management that defined the project's cosmology. Not surprisingly, expectations of a new computerised modernity did not materialise, and the project was plagued by endless organisational and technical problems. However, as the essay argues, these problems can be considered sites of encounter and resistance, where the conflict between different cosmotechnics becomes apparent. Based on original archival documents, the essay interrogates these resistances to universalist ideas of technology and ontological assumptions embedded and perpetuated through the architecture of post-colonial 'development' projects. This study serves as a first stepping stone towards further investigations into how Western homogenising technologies could be negotiated and challenged for a more pluralistic technological paradigm.

Keywords:
Technology, computer, architecture, prefabrication, Zambia, Norway

The World Bank Education Project in Zambia

'There have been many occasions during the past six months, and there will undoubtedly be more during the next six when I have wished – and will wish for a Point of Aries to which to relate and charter our way through the problems of this project!' lamented Norman Taylor, an architect-in-charge of the infamous World Bank Education Project in Zambia in the opening paragraphs of an official quarterly report for April–September 1977.[1] This remark, seemingly out of place in an official bureaucratic document, referred to Geoffrey Moorhouse's book *The Fearful Void*, in which the author recounts his 3600-mile solo odyssey across the Sahara desert on foot.[2] In preparation for his journey Moorhouse learned about the astronomical first point of Aries – an imagined intersection between the path of the sun (the Ecliptic) and the celestial equator (the Equinoctial) on 21 March each year. An immaterial invention of astronomers and navigators, the first point of Aries regulated relationships between celestial bodies, defined trajectories and predictable moments and assisted in circumnavigation for centuries.[3] For Taylor, such a system of coordinates seemed to hold a valuable promise: '[the point of Aries] gives a man trying to find his way across the wilderness

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of the earth a security that he can find if only he learns the secret of using Aries correctly.'[4] The architect-in-charge longed for a similar celestial body to provide a moment of respite and certainty in the never-ending dragged-beyond-any-reasonable-deadline building venture colloquially dubbed the 'Wild Bank Project' by its participants.[5]

Indeed, the Zambia World Bank Education Project was an undertaking of wild ambitions and Sisyphean proportions. Finalised in 1968, it envisioned the construction of nine new high schools, four new teacher training colleges, one new technical school and improvements and extensions to fifty-six existing secondary schools.[6] With more than seventy simultaneous building sites scattered across more than two thousand kilometres, it was to provide twenty-four thousand new educational places and prepare a new generation of the Zambian workforce for the demands of the post-independence economy.[7] [Fig. 1] Financed with a $30 million loan from the World Bank and with the technical assistance of the Norwegian Agency for International Development, the project was to accomplish these goals in a mere five years. New regulatory and planning bodies were set up within the Zambian ministries to streamline the process, international experts flew from four different continents, and computer-aided technologies were implemented with dramatic and far-reaching consequences. At times, however, it seemed that circumstances conspired against the project: wars ensued, borders were closed, rains washed the roads out, electricity lines were cut off, contractors went bankrupt, copper prices plummeted, materials and objects were stranded in ports or mid-air, items of furniture were wrongly sized, glass elements went missing, and wall panels were broken and twisted out of place. Despite visions of continuity, five project directors and three architects changed through soap-opera-worthy dramatic conflicts.[8] Only the celestial bodies could provide a moment of respite in the project that seemed to have been cursed by the endless turmoil of unpredictable events.

However, as I will argue, these events were not that unpredictable. After all, this was a reality of a large building project conducted in a newly independent country, financed by a wide range of international actors with the involvement of foreign 'experts' and more than fifty contractors, entrepreneurs and local builders. The delays and technical problems were inevitable, resulting from planning and technological decisions taken early in the project. As invited planners implemented imported technologies, they reproduced epistemological and ontological assumptions embedded into Western technology in a setting governed by an entirely different cosmology. These problems and resistances within the Zambia World Bank Education Project can be considered not as ruptures but as sites of encounter between different cosmotechnical orders.[9] This essay draws from the plural understanding of 'cosmotechnics' as defined by Yuk Hui and explores this plurality by investigating technological tensions in a transnational architectural project. The Zambia World Bank Education Project is a particularly appropriate case study of how technological choices harbour epistemological and ontological assumptions that are exported, internalised and reproduced through modernisation and globalisation. Technologies of construction and project management define not only what gets built and how, but also shape the modes and cosmologies of thinking about architecture. As the project brought many actors together across cultural, national and epistemological divides, it offers an opportunity for an in-depth comparative cosmotechnical inquiry that challenges the universalist ideas of technology perpetuated by Western modernity. Responding to this issue of *Footprint's* call for contributions, in this essay I will pay particular attention to the conditions of the emergence of new technology applied in the project and trace its path as it was exported and translated. By looking at the many bureaucratic documents of the project as ethnographic objects, I will investigate constellations of actors and agendas involved in the planning and decision-making of this project and scrutinise the originary implications of their respective cosmotechnics.[10]

Good business

The education sector was a crucial priority in Zambia's First National Development Plan, drafted immediately after the country's independence in 1964. Zambia had some of the lowest education levels in the region, and it was estimated that the lack of school buildings and teachers prevented the country from dynamic economic development.[11] The first 'mapping' of Zambian education needs was conducted between February and March 1966 by a UNESCO delegation.[12] With its roots in Western organisational principles, UNESCO's studies were laced with imported epistemic assumptions that perpetuated the technoscientific priorities of industrialised nations.[13] Reports produced by UNESCO, in cooperation with the UN Development Program and the Food and Agriculture Organisation, calculated the necessary outputs in terms of manpower needs and estimated that the Zambian economy needed more than twenty-four thousand new schoolplaces.[14] Plans for an obligatory four-year common school were set in place, and several hundred teachers were recruited from abroad.[15] Throughout 1968, UNESCO's appraisal mission worked with the Zambian Ministry of Education on a loan application to the World Bank.[16] The negotiations concluded on 11 April 1969: the bank agreed to cover 60 per cent of the total $44 million cost and the foreign exchange component.[17] The project was to last four years, starting promptly on

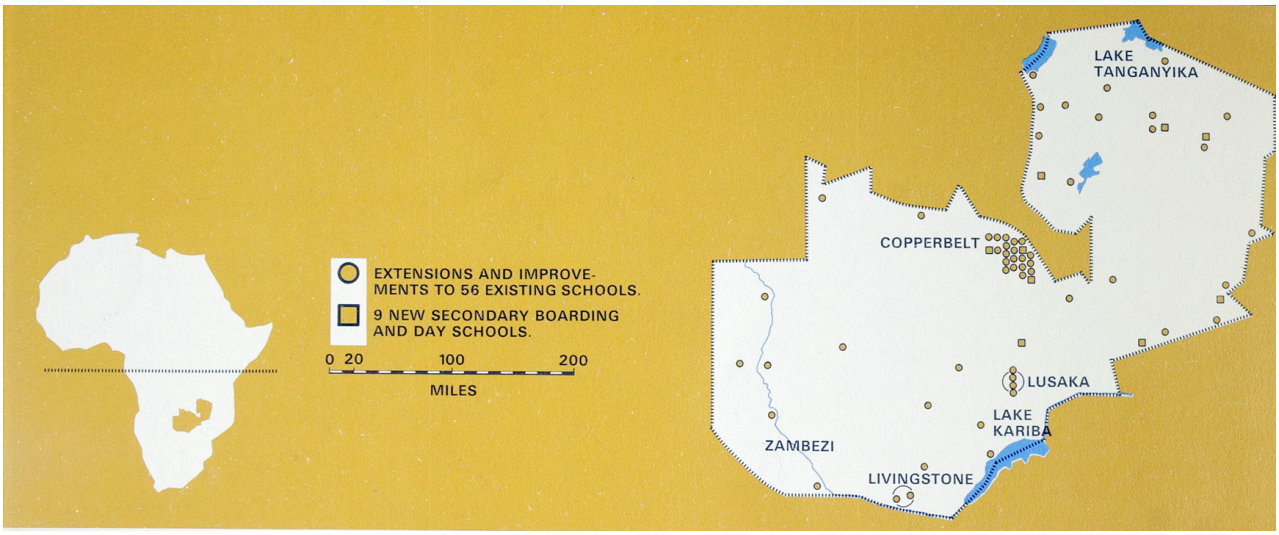


Fig. 1: Building sites of the Zambia World Bank Education Project. Norconsult booklet, 1977.

15 July 1969. At the time negotiations for the loan were underway, Zambia's economy was evaluated positively, so the loan was administered through the International Bank of Reconstruction and Development (IBRD) and not the International Development Association (IDA), which meant that the loan had to be repaid within fifteen years in a period from July 1979 to 1994.[18]

This was the first educational project of such a scale for the World Bank, which was at the beginning of its expansion into education.[19] The bank's role was limited to financing and supervision, it was not responsible for the administration of the project. The borrower had to establish a project unit within the Ministry of Education that would employ and supervise qualified firms of architects, engineers, quantity surveyors and clerks of work.[20] In 1969, Norad, the Norwegian Agency for International Development, stepped into the picture and agreed to cover 70 per cent of the costs for all technical personnel. The Norwegian directorate also financed a third of the bank's loan through multi-lateral agreements.[21] While one might wonder how Norway ended up paying for the Zambian school project, this resulted from a longer-term constellation of Nordic interests in southeast Africa.

Norsk Utviklingshjelp (later renamed Norad) was a Norwegian organisation founded in the mid-1950s to provide bilateral technical and financial assistance to 'developing' countries. In 1962, following the ascendance of Julius Nyerere in Tanganyika, whose political ambitions aligned with those of Nordic partners, Swedish, Norwegian and Danish agencies began their work in southeast Africa under the joint interparliamentary Nordic Council (Nordisk Råd).[22] Tanzania, Zambia, Kenya and Uganda were chosen as 'focus areas' based on the principle of geographic concentration.[23] Norwegian urban theorist Karl Otto Ellefsen argues that Nordic involvement on the continent could be seen as an extension of the tradition of protestant missionaries who strove to impose 'good' by transferring ideas, knowledge and money.[24] There was a shared belief among the Nordic politicians that the social-democratic model could be exported and translated into practical use even in a different socio-economic and geographic context.[25] Projects in education and healthcare were prioritised, since they also contributed to creating the North's idea based on 'common goodwill.'[26] By 1965, Nordisk Råd completed a large Kibaha school project in Tanganyika that integrated education, healthcare and agriculture and consisted of a secondary school, training health centre, farmers' training college, and several units for rural development, nutrition and home economics.[27] Beyond joint projects, each Nordic country pursued bilateral agreements in the region. In 1967, Norway signed an official framework agreement with Zambia, where Norad was to assist in recruiting teachers, engineers, architects, agriculturalists and nutrition experts that would work in different state institutions.[28]

The scheme's Nordic roots are crucial in understanding the Zambian World Bank Educational Project. In the 1980s, Norwegian political scientist Terje Tvedt coined the term 'regime of goodness' to describe Norwegian moral and political ambitions in foreign policy.[29] Cultural theorist Nina Witoszek later developed the idea, arguing that, to a large extent, the idea of 'Nordic goodness' was a product of deliberate international marketing and a 'result of mass delusion'.[30] This image of 'goodness' is based on a largely unexamined story of 'a small forest kingdom which radiated sweetness and light while disseminating goodness to the less fortunate' parts of the world.[31] Situated far from the colonial networks, Norway seemed to be unstained by the moral implications of the colonial past. However, as Witoszek argues, the 'regime' aspect of the term is equally important, as it refers to the heavily technocratic and controlling nature of this 'goodness'. Following Tvedt, in this essay I maintain that images both of 'goodness' and technological control were instrumental to Norwegian participation in Zambia World Bank Education Project.

Norwegian experts and volunteers worked in different parts of the Zambian state and educational institutions since 1965 and enjoyed great respect.[32] Norwegian architect Halvor Fossum worked for the Zambian Ministry of Education following his engagement in the Tanganyika project, where he was employed by a large Norwegian consultancy, Norconsult. Not only did Fossum develop a vast network of social connections within the Zambian state apparatus, but he was so well-liked that he was entrusted with representing Zambia in the negotiations with the World Bank in Washington.[33] Unsurprisingly, he was also instrumental in introducing Norwegian interests into the project.[34] If an international consultancy were to be hired for the Zambia Education Project, Norconsult, former Fossum's employer, would be an obvious choice – although Zambia was free to consider other options.[35] In case Norconsult was chosen, however, Norad agreed to cover 70 per cent of the entire payroll for the technical personnel – making the offer nearly irresistible.[36]

Here, the implications of the 'regime of goodness' become apparent. For the Zambian state, the Norwegian partners seemed reliable and untainted by the colonial past. Most importantly, they were generous, alleviating the financial burden and simplifying the exhaustive search for qualified expertise required by the World Bank rules. From the Norwegian side, however, this was not a gift but a pragmatic business. By hiring Norconsult, Norad was sure to get a large 'good' project off the ground and onto the books, while the consultancy would get a lucrative project essentially paid for by their state department. Fossum,

mediating between the interests of Zambia, Norad, and Norconsult, was essential for this project. Norwegian consultants, informed of the Zambian intentions, took over the responsibilities of the state department and cajoled the Zambian delegation visiting Oslo in the autumn of 1968.[37] The decision to hire a Norwegian engineering consultancy for a school-building project in Zambia had long-lasting physical and material implications that were hard to predict.

The experts

By August 1969, contract details were worked out between the World Bank's Danish architect, Carl Hammerschmidt, the newly hired Norwegian project director, Finn Meland, and Halvor Fossum. The World Bank accepted Norconsult as a firm 'qualified to carry out the work under the loan provided'.[38] Established in 1964, Norconsult was a conglomerate of smaller engineering firms whose goal was to export 'technical know-how' to the developing world.[39] By combining engineering, architecture and construction expertise, the firm could meet the demands of the global construction market where single Norwegian firms could not compete.[40] For consultancy services in the Zambia World Bank Education Project, Norconsult was to receive NOK 11 250 000, and provide over sixty-eight years of manpower.[41]

The project also required new administrative bodies within the Zambian state. A project unit was set up at the Ministry of Education as the main coordination centre dedicated to running the entire project and directly accountable to the World Bank.[42] It was to make most of the planning decisions, select, brief, coordinate and supervise firms of architects, engineers and quantity surveyors, and liaise with contractors.[43] The project unit, comprised of four experts, the project architect, the project director and secretarial staff, were all Norwegians hired by Norad. The project director was to set up the administrative control of the project. He was responsible to the Permanent Secretary of the Ministry of Education and the directors of the World Bank. The Ministry of Education and the project unit were to monitor the project's progress, while all major decisions had to be approved by the bank's representatives.[44] In this way, an entirely Norwegian administrative infrastructure was set up within the project, where Norwegian architects and engineers liaised with their colleagues from Norconsult.

Norconsult's tasks were all-encompassing, including the project's preparation, planning, design and supervision. Despite the firm's experience in other African countries, none of the consultants had worked in Zambia. Norwegian experts were expected to start as soon as possible, joining representatives of the Ministry of Education on aeroplane 'familiarisation tours' of school sites scattered across the country.[45] The consultants were to deliver a preliminary report that assessed the state of the Zambian construction industry and building costs, detailed the availability of raw materials and investigated existing building materials. Drawings of the existing schools awaiting transformation had to be recovered or drafted anew, since they were either non-existent or misleading.[46] If the entire school project was necessary for the new Zambian state as a display of governmentality, topographical and geo-spatial information obtained in the preliminary study was an essential step towards establishing this governmentality.

In *A Genealogy of Tropical Architecture*, Jiat-Hwee Chang argues that buildings, architecture and construction, alongside statistics, maps, medical knowledge and sanitary practices, become acts of governmentality.[47] In the case of the Zambia Education Project, it was not just the future school buildings that belonged to what Ariandam Dutta describes as a 'linear theme of power-display-knowledge', but also the techniques and technologies implemented in their production process.[48] The act of mapping – and the view from the aeroplane – re-instated the cosmology of Western technics, in which the land was 'readable as property' and the world was organised in terms of productive economic and governance potentialities.[49] The Zambian state's facilitation of this technological reiteration exemplifies the complexity of post-colonial nation-building and the persistent character of colonial practices and cosmologies.[50]

The cosmotechnical differences were already detected and briefly discussed in the 120-page report prepared by Norconsult in 1970. In the view of Norwegian consultants, the Zambian construction industry was considered 'set back for unspecified reasons', there was a general lack of building materials and of skilled and semi-skilled manpower.[51] As large post-independence projects were drawing to a close, there were fewer contractors in the industry, and many were not interested in projects outside the urban centres. Under these conditions and within the limited time framework of the project, the consultants saw 'no other choice than a partly industrialised prefabrication system combined with conventional building methods'.[52] Prefabrication was envisioned along the lines of the British CLASP system, where lightweight industrial components from local producers could be used if the producers could cope with the demands of mass production. The components would be delivered on-site and raised in combination with conventional trades. Such a system would speed up the project, as work could happen simultaneously at the factory and on site. The application of unskilled labour trades would be reduced to a minimum, while the manpower of the qualified staff would be fully utilised on site.

However, although the Norwegian consultants perceived a local lack of skilled labour and low levels of craftsmanship, this was not necessarily the case. As a 1977

project evaluation report later indicated, 'this opinion was not normally shared by contractors and local consultants'.[53] Indeed, from the client's point of view, it would have been most beneficial to use as much local materials and labour as possible. The original contract agreement stipulated that consultants should investigate alternative choices of materials and local contractors to secure the project remained within limited budgets.[54] However, due to structural constraints of the international aid provision, the project moved very quickly, and the consultants continued to emphasise the exceptional labour and material conditions in favour of an industrial building system.[55] This planning decision was a consequence of a particular cosmology that called for a selection of specific technics. In their book 'Laboratory Life: The Construction of Scientific Facts', philosophers Bruno Latour and Steve Woolgar discuss how scientists use inscription devices to create a seemingly objective reality in a laboratory.[56] Similarly, by reiterating and documenting the perceived lack of local skilled labour and material shortage, the Norwegian engineers created a seemingly objective reality in which using an industrial construction system seemed the only viable option. If, following Latour and Woolgar, phenomena are constituted by the material setting of the laboratory, then cosmotechnics also depends on and is created by the technically mediated epistemological dimension. In the cosmotechnics of the Norwegian engineers, the scale and conditions of the Zambia World Bank Education Project offered a unique opportunity to test unconventional building technology – although local specialists may have perceived the situation differently.

Towards a new architecture

The Norwegian consultants proposed a construction system that relied on industrially-produced modular components. The conventional approach at the time suggested standardised floor plans. Instead, Norconsult proposed standardising single-room units – classrooms, laboratory, library, workshop, and sanitary facilities.[57] [Fig. 2] This system matched the project's core organisational idea, which encouraged a transition to the basic subject room system, where rooms would be used for specialised subjects during instruction hours.[58] With standardised room units, architects did not have to create new school designs for each of the seventy building sites. Rather, different constellations of rooms could be arranged depending on site conditions, air circulation and insulation. This system also minimised the circulation spaces and made layouts more compact, reducing the costs of water and sanitation works.

With the client's educationalists, the Norconsult architects developed around fifty room units, where room dimensions varied depending on teaching and activity requirements.[59] Volumes could be linked in different directions, creating various spaces. The schools were single-storey buildings set on a standardised block foundation. The load-bearing structure was comprised of cross-shaped columns and U-shaped beams. [Fig. 3] The frame could then be filled with prefabricated asbestos sandwich panels, custom-designed for the project, standardised louvred window elements, and fibreglass panels.[60] Characteristic steel roof arches covered with corrugated asbestos roof sheeting lent the project its signature appearance.[61] [Fig. 4]

Technically, the modular framework was set on a grid of eight by eight metres, with a planning grid of one by one metre and an even finer planning network of 1 decimetre, abbreviated as 1M.[62] The problem with the module, however, was that it implied a transition from British imperial to metric units.[63] Until then, Zambia's construction industry followed imperial measures, but a general transition was envisioned by the end of 1973. The client – and consequently the project unit – instructed Norconsult to use the metric system according to ISO recommendations in all planning for the secondary schools.[64] Although a seemingly trivial decision, this exemplifies yet again the imposed character of the standardised technology unfamiliar to local contractors. Transitioning to the ISO standards would open the project to an international market, forcefully re-inserting it into the cosmotechnics of a unified global capitalist market.[65] However, the intricacies of the metric system had to be explained to the contractors in a special pamphlet with drawings.[66] Advocated for in Zambia, the 1M module was adapted in Norway just a few years prior, and the ISO standardisation still lagged.[67] The Norconsult engineers thus implemented a new technoscientific modernity in Zambia that was hardly possible at home.

This modernity did not stop at the modular construction system. Since all building elements – walls, cladding, floors, windows, louvres, partitions, cupboards, benches and furniture – across seventy construction sites and two thousand kilometres had to conform to the same modular network, there were more than five thousand drawings to control for.[68] From the onset, Norconsult proposed to use a new computer management system, a 'Co-ordinated Building Communication', or CBC for short. The CBC system canalised communication flows between specialists and facilitated the management and organisation of large construction projects.[69] Each building component, material or labour operation would receive a code that was then integrated into the central catalogue and stored on magnetic tape. Different construction documents – drawings, bills of quantities, specifications and price lists – cross-referenced using the same code. [Fig. 5] This was a way to represent the entire building project through codified values and control the elements across all building

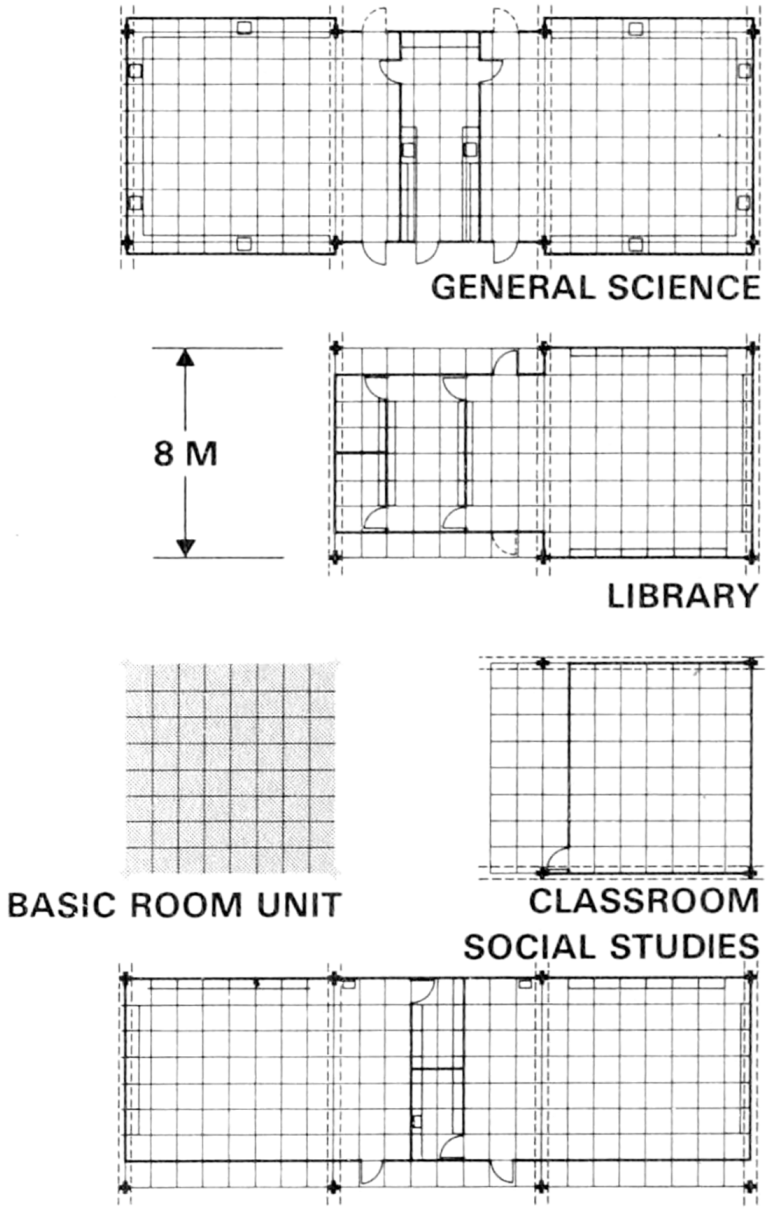


Fig. 2: Basic planning grid proposed by Norconsult. Norconsult booklet, 1977.

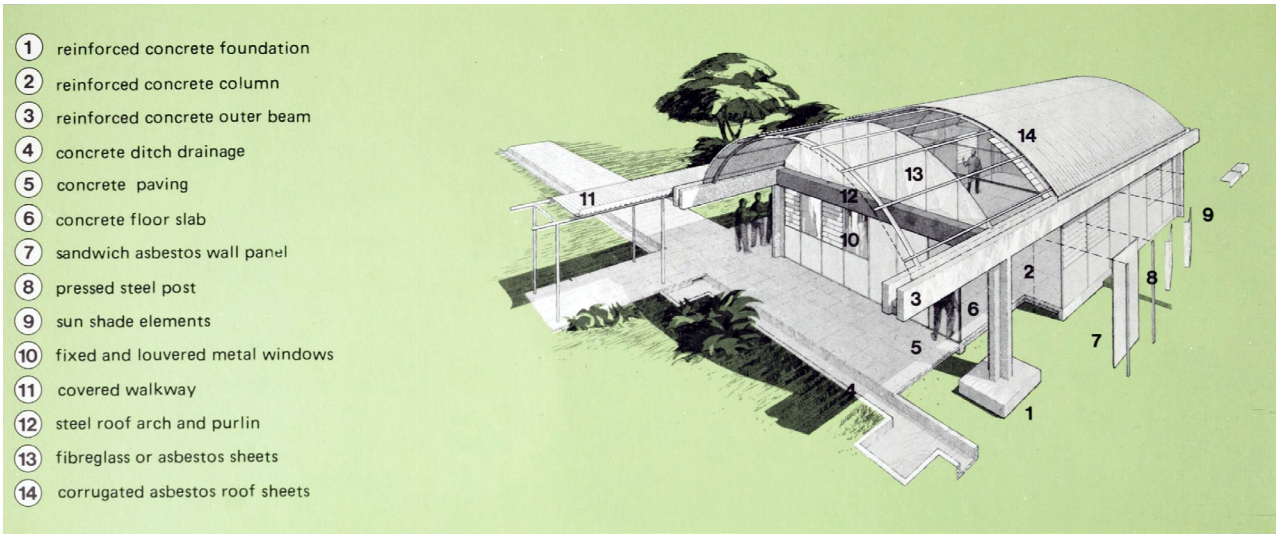


Fig. 3: Elements of a typical classroom unit designed by Norconsult. Norconsult booklet, 1977.

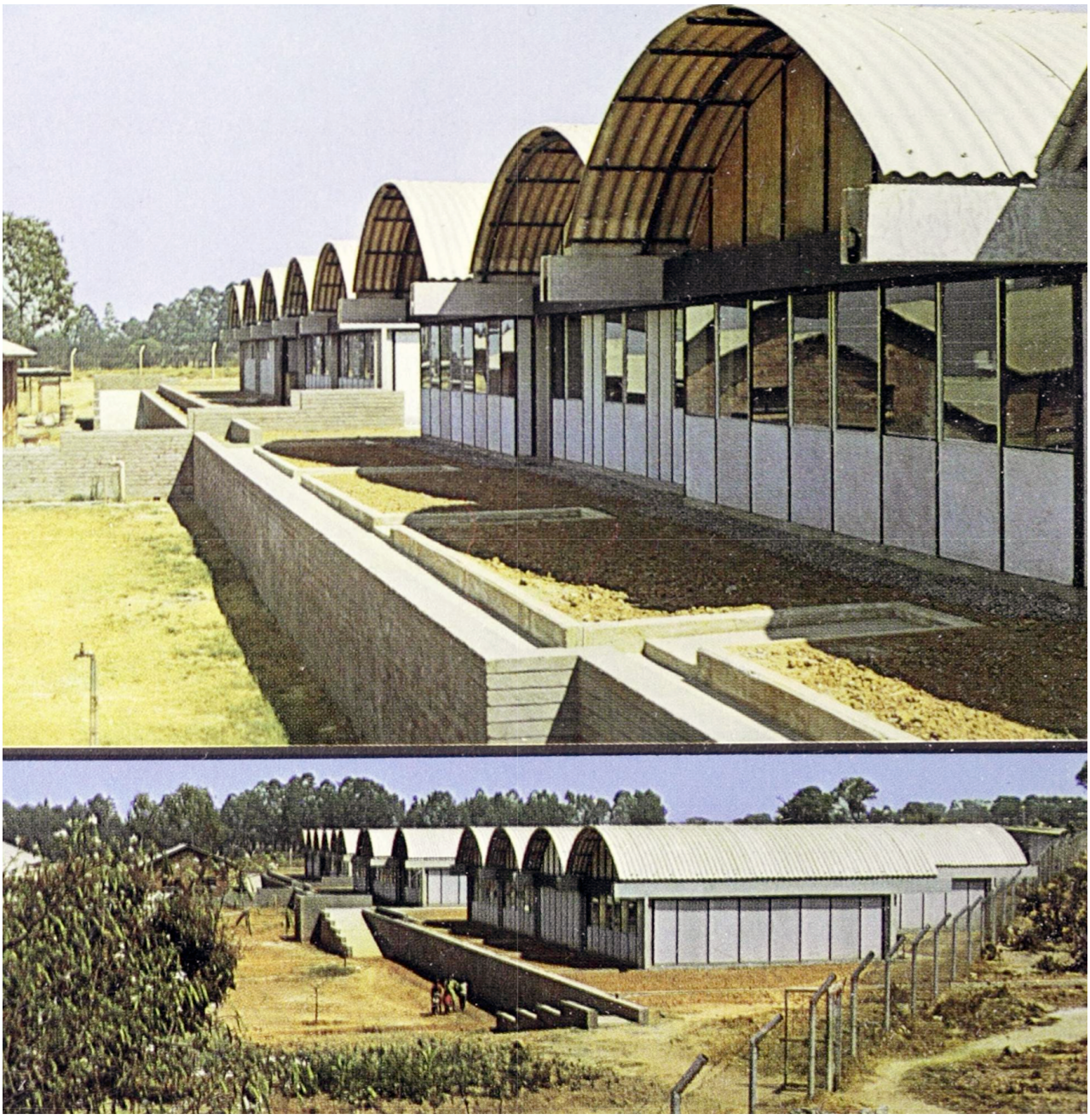


Fig. 4: Typical school pavilions. Norconsult booklet, 1977.

documents. If project documents were correct for one of the schools, they would be right for the rest of the sixty-four schools.

One of the decisive factors in favour of the CBC system was that the consultants could use the Lusaka Data Processing Unit situated at the Ministry of Finance.[70] Since Norconsult had no experience with the data processing system, a senior Danish quantity surveyor flew to Lusaka in May 1970.[71] He was to start working on the central catalogue and introduce the staff at the data centre to the new system while the plans for all the schools were finalised. The same quantity surveyor was expected to return for another ten weeks in September 1970 to continue to work on the master catalogue, and to return yet again at the beginning of 1971 with tender documents for each school. Meanwhile, tapes for each school would be sent to Copenhagen and Oslo to be processed on computers there and then delivered back to Lusaka, where it would be possible to reproduce complete sets of tender documents.[72] [Fig. 6] The computer-based documentation system provided 'significant savings in writing, machine writing, control reading and document production', and allowed Norconsult to work in two teams split across two continents.[73]

Although promising in principle, the computerised reality was far less rosy. The capacity of the data centre was limited, so only two functions of the CBC system could be implemented. The data centre grew in demand among many Zambian governmental institutions, and the time allocated to the Nordic consultants was insufficient.[74] Most of the printing had to happen at night, and these night shifts, according to the project director, resulted in a significant strain on the staff and led to many errors and omissions in the tender documents.[75] The process was heavily dependent on the specialised knowledge of quantity surveyors and programmers, and since their local counterparts were never trained, this resulted in long delays.[76] For example, when the finance controller was sick for several weeks, it was impossible to compute certain documents and specifications required for the project for weeks.[77] However, and most importantly, the implicit technological (and arbitrary) logic of this managerial system had a tangible impact on the project's architecture.

Lasting impressions

CBC originated in Denmark, designed by two brothers, Bjørn Bindslev, 'a Danish architect by training and natural philosopher by inclination', and Knud Bindslev, an engineer and early computing specialist.[78] It was an adjusted version of the Swedish sorting system used for classifying and cataloguing building work and materials in Sweden since 1947 (the SfB system), later adapted for the British market. As the system architects argued, knowledge of quantities was a fundamental pre-condition for effective project management, where materials and labour constituted two main quantifiable elements of the process. However, with its roots in the Swedish system of tender documentation, CBC split the traditional 'all-in-one' tender rates and required contractors to quantify labour and materials into two separate categories of 'activities' and 'resources'.[79] This imposed separation was foreign to many European tender practices, and was used in Sweden and Denmark only. In Norway, the CBC system first appeared in the professional press in 1964, following the extensive marketing efforts of the Polish-educated architect Janusz Ziolko, who headed the Norwegian subsidiary company of the Danish Byggeadminisratsjon.[80] CBC was promoted as part of the aspiration to unify the Nordic construction market, but it was, nevertheless, not recommended for use in Norway. The Norwegian Building Research Institute evaluated the system in a 1967 report, in which engineer Hans Sundh concluded that

> the Norwegian tradition of contracting required a different logic so that the building material and labour costs had to be included as a single entity in the final amount. If [CBC] would be used for Norwegian conditions, it should be done so that there would be no split between the single elements and the work operations – otherwise, the use of the system would be too expensive.[81]

Even in Sweden, the system's rigid logic, which limited its functional flexibility, received much criticism from building specialists.[82]

In Zambia, not surprisingly, the application of the CBC system ran into precisely the same problems outlined for Norway. Zambian contractors were used to working from drawings without relying heavily on the specifications and bills of quantities. The CBC system established a preference for the bills of quantities over drawings, and the computer-generated documents were nearly illegible for any non-trained specialists. [Fig. 7] The CBC logic, which separated elements, construction activities and materials and measured projects in terms of areas and volumes, was so obscure to local contractors that it resulted in lower estimates, incorrect pricing and omissions.[83] Entrepreneurs signed documents without fully understanding what they signed, which led to many delays, disputes and extra costs.[84] Although Norconsult was supposed to arrange introductory courses for local builders, these courses were done in a highly specialised technical language not understandable even to people with professional and technical backgrounds. According to the later reports, no contractors could take advantage of the complex CBC system even five years later.[85]

Tabell 8.04.2. Kodestruktur i 2. og 3. fasett

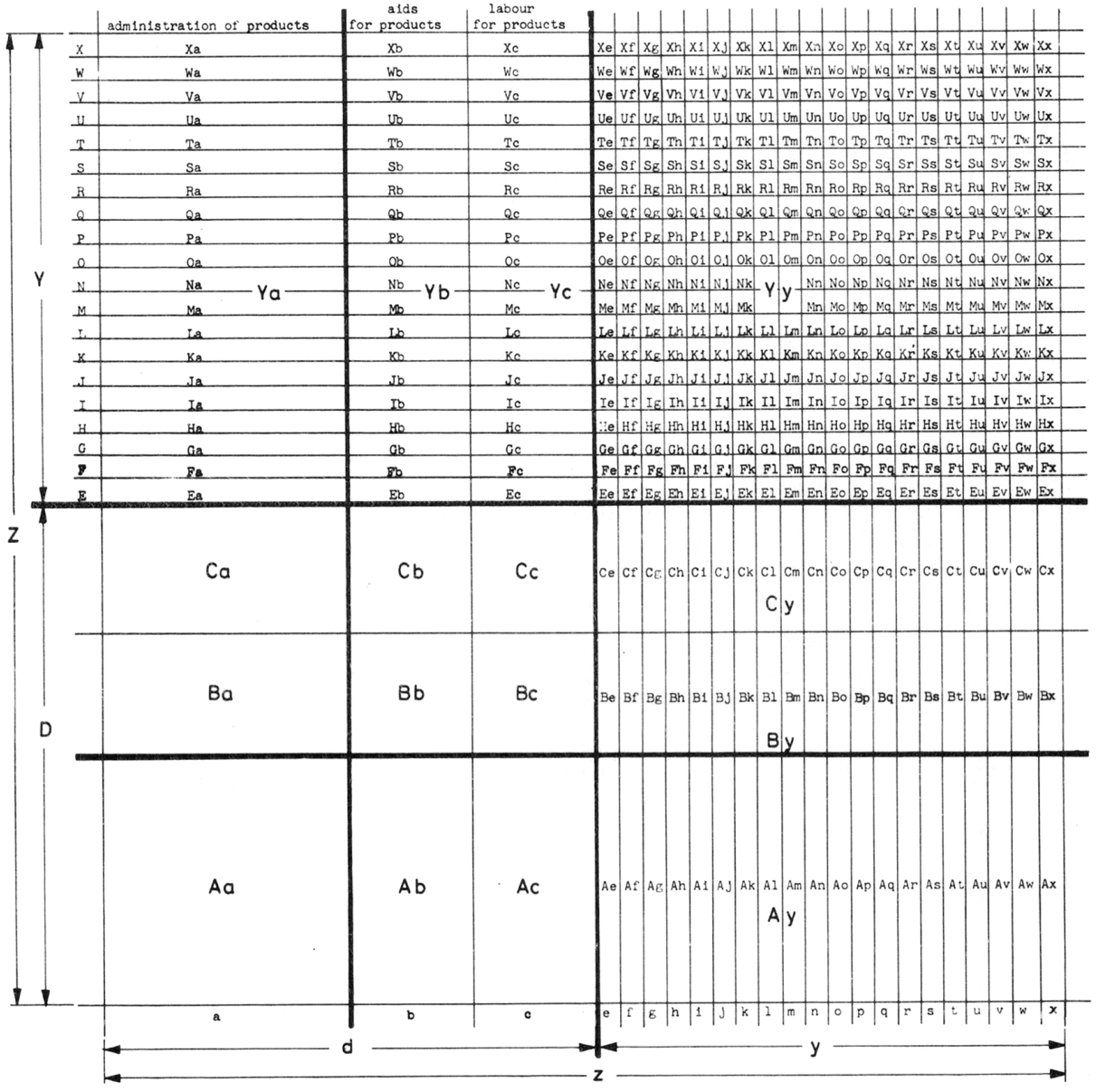


Fig. 5: Coding principles of the CBC system. Teknisk Ukeblad, 1969.

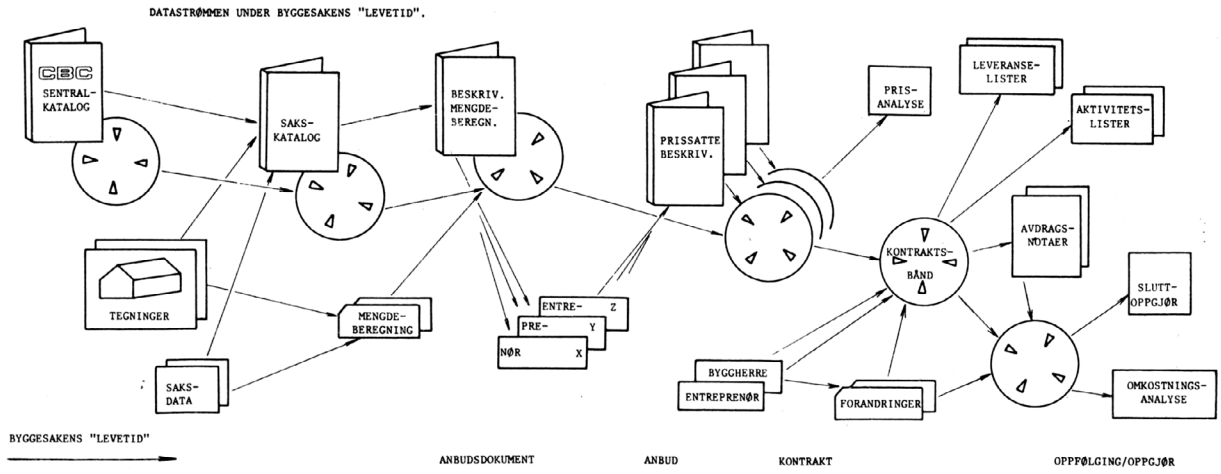
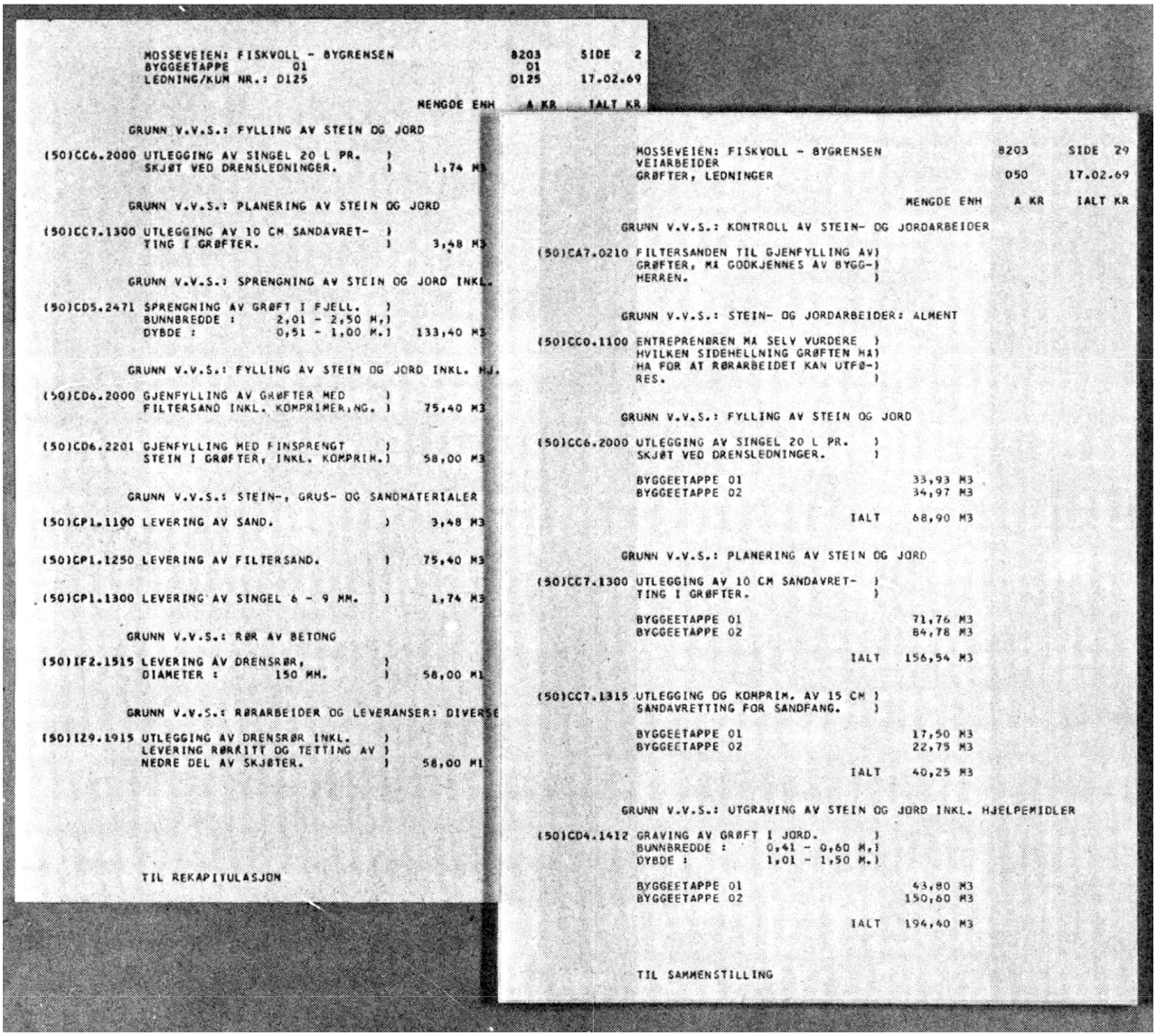


Fig. 6: Envisioned ‘data stream’ facilitated by the CBC building documentation system. Teknisk Ukeblad, 1969.



MOSSEVEIEN: FISKVOLL - BYGRENSEN 8203 SIDE 2
BYGGEETAPPE 01 01
LEDNING/KUM NR.: D125 D125 17.02.69

MENGDE ENH A KR IALT KR

GRUNN V.V.S.: FYLLING AV STEIN OG JORD

(50)CC6.2000 UTLEGGING AV SINGEL 20 L PR. SKJØT VED DRENSLEDNINGER. 1,74 M3

GRUNN V.V.S.: PLANERING AV STEIN OG JORD

(50)CC7.1300 UTLEGGING AV 10 CM SANDAVRETTING I GRØFTER. 3,48 M3

GRUNN V.V.S.: SPRENGNING AV STEIN OG JORD INKL.

(50)CD5.2471 SPRENGNING AV GRØFT I FJELL.
BUNNBREDDE : 2,01 - 2,50 M,
DYBDE : 0,51 - 1,00 M. 133,40 M3

GRUNN V.V.S.: FYLLING AV STEIN OG JORD INKL. HJ.

(50)CD6.2000 GJENFYLLING AV GRØFTER MED FILTERSAND INKL. KOMPRIMERING. 75,40 M3

(50)CD6.2201 GJENFYLLING MED FINSPRENGT STEIN I GRØFTER, INKL. KOMPRIM. 58,00 M3

GRUNN V.V.S.: STEIN-, GRUS- OG SANDMATERIALER

(50)CP1.1100 LEVERING AV SAND. 3,48 M3

(50)CP1.1250 LEVERING AV FILTERSAND. 75,40 M3

(50)CP1.1300 LEVERING AV SINGEL 6 - 9 MM. 1,74 M3

GRUNN V.V.S.: RØR AV BETONG

(50)IF2.1515 LEVERING AV DRENSRØR,
DIAMETER : 150 MM. 58,00 M1

GRUNN V.V.S.: RØRARBEIDER OG LEVERANSER: DIVERSE

(50)I29.1915 UTLEGGING AV DRENSRØR INKL. LEVERING RØRRITT OG TETTING AV NEDRE DEL AV SKJØTER. 58,00 M1

TIL REKAPITULASJON

MOSSEVEIEN: FISKVOLL - BYGRENSEN 8203 SIDE 29
VEIARBEIDER
GRØFTER, LEDNINGER 050 17.02.69

MENGDE ENH A KR IALT KR

GRUNN V.V.S.: KONTROLL AV STEIN- OG JORDARBEIDER

(50)CA7.0210 FILTERSANDEN TIL GJENFYLLING AV GRØFTER, MÅ GODKJENNES AV BYGGHERREN.

GRUNN V.V.S.: STEIN- OG JORDARBEIDER: ALMENT

(50)CC0.1100 ENTREPRENØREN MÅ SELV VURDERE HVILKEN SIDEHELLNING GRØFTEN MÅ HA FOR AT RØRARBEIDET KAN UTFØRES.

GRUNN V.V.S.: FYLLING AV STEIN OG JORD

(50)CC6.2000 UTLEGGING AV SINGEL 20 L PR. SKJØT VED DRENSLEDNINGER.

BYGGEETAPPE 01 33,93 M3
BYGGEETAPPE 02 34,97 M3
IALT 68,90 M3

GRUNN V.V.S.: PLANERING AV STEIN OG JORD

(50)CC7.1300 UTLEGGING AV 10 CM SANDAVRETTING I GRØFTER.

BYGGEETAPPE 01 71,76 M3
BYGGEETAPPE 02 84,78 M3
IALT 156,54 M3

(50)CC7.1315 UTLEGGING OG KOMPRIM. AV 15 CM SANDAVRETTING FOR SANDFANG.

BYGGEETAPPE 01 17,50 M3
BYGGEETAPPE 02 22,75 M3
IALT 40,25 M3

GRUNN V.V.S.: UTGRAVING AV STEIN OG JORD INKL. HJELPEMIDLER

(50)CD4.1412 GRAVING AV GRØFT I JORD.
BUNNBREDDE : 0,41 - 0,60 M,
DYBDE : 1,01 - 1,50 M.

BYGGEETAPPE 01 43,80 M3
BYGGEETAPPE 02 150,60 M3
IALT 194,40 M3

TIL SAMMENSTILLING

Fig. 7: Output documents of the CBC system. Teknisk Ukeblad, 1969.

Practical problems got worse once the project went into the construction phase. Drawings were often misinterpreted on site, resulting in construction mistakes and last-minute alterations. Lists of computerised specifications were 'too sophisticated to be easily understood by the man on a building site'.[86] They required interpretation from the supervisory staff, who had not received proper training to use the system either. Much of the reporting and payment bills on site had to be prepared by the supervisory engineers on behalf of the contractors, adding additional strain on the personnel.[87] On-site alterations and corrections, in turn, had to be re-coded on additional tapes and then re-integrated into the system, defying the principle of a central catalogue.[88] In practice, this led to the bizarre situation where the work carried out was quite simple, but its administration required highly qualified staff, which was not always available.[89] In the end, it seemed that only Norconsult consultants used the system, which proved 'too complicated and too cumbersome', while the other actors preferred to use the established and familiar systems of bills of quantities.[90] Although the CBC system was intended to alleviate the client's workload, it increased that workload, since the Zambian state relied on conventional accounting methods.

One of the main benefits of the CBC system was that at any point during planning or implementation, it was possible to recover measured quantities. However, these estimated quantities proved irrelevant, given the turbulent reality of the 1970s Zambian economy. Despite the original intention to use as many local materials as possible, few local suppliers qualified under the World Bank rules, and many of the components and equipment had to be shipped from abroad. Most of the materials came from Rhodesia and South Africa, imported via a southern route over the Benguela Railway via Lobito and by road via Dar es Salaam.[91] When the border with Rhodesia closed on 9 January 1973, and imports from South Africa were banned, the project's supply chain was disrupted dramatically.[92] Materials, tools and equipment were stranded in seaports, storage facilities and on roads indefinitely.[93] Following the oil crisis, steel and timber prices increased three-fold, while copper prices plummeted.[94] No computer-generated specifications could speed up the process locked in political turbulence.

With the many contractual mistakes, delays in the process, lack of materials and poor management, construction work lagged far behind schedule. Contractors experienced severe financial problems, which worsened over the years, and the Zambian state had to step in to rescue several contractors from inevitable bankruptcy.[95] Furniture procurement and production by the Prisons Department constitute a separate and dramatic chapter of the project.[96] Water tanks were not properly welded, workmanship on the many sites left much to be desired, and the supply of crucial materials – asbestos, fibreglass and wall panels – continued to be erratic.[97] By 1977, custom-designed prefabricated wall panels showed signs of 'extensive and disastrous' failure, and 10 per cent had to be replaced.[98] Although these problems were not a direct consequence of imported technology, they show a profound conflict between different cosmotechnics. The seemingly rational Western technology of project management could do little to streamline the processes in a different political and geographic context whose cosmos was organised according to an entirely different set of epistemologies.

The project and its computer management system were so obscure that in 1978 it came under the scrutiny of the Zambian state. As the project was ending, the project's architect, Norman Taylor, and the project's financial controller, Mr. A. M. Herland, were called for questioning by the Public Accounts Committee assigned by Parliament. As Taylor recalled, intimidating paraphernalia of 'subdued lights, microphones and tape-recordings' was reminiscent of the contemporary interrogation chamber, but the committee's questions were answered.[99] Eventually, all computer-produced documents had to be transformed into conventional form.[100] The CBC system was one of the project's main components and made a big impression on everyone involved. Taylor, the project's longest-serving architect, quoted Einstein, saying that 'modular' was a way 'to make the good easy and the bad difficult'. For Norman Taylor, CBC came to signify 'confusion by computer', and, as he passionately declared his last report, 'anything relating to computers for quantities I would avoid like the plague!'[101] Indeed, before the 'Wild Bank' project was over, the CBC Denmark went bankrupt. In response, Taylor merrily and somewhat vengefully declared: 'The CBC system is now dead!'[102]

Beer and skittles

'To pretend that it has all been beer and skittles would be to deceive. It has been a battle and a challenge', was Taylor's final conclusion on the project.[103] The case of CBC application in school design was particularly interesting, not because of the many challenges it introduced, but because of the symbolic role it acquired in the project. [Fig. 8] According to Norconsult, the CBC system 'liberated the architects and engineers from the tiring and monotonous routines and provided opportunities to work with more meaningful and creative work'.[104] However, most of the time, the architects and engineers were occupied with solving the many problems caused by the system. Both modular construction and CBC promised a new

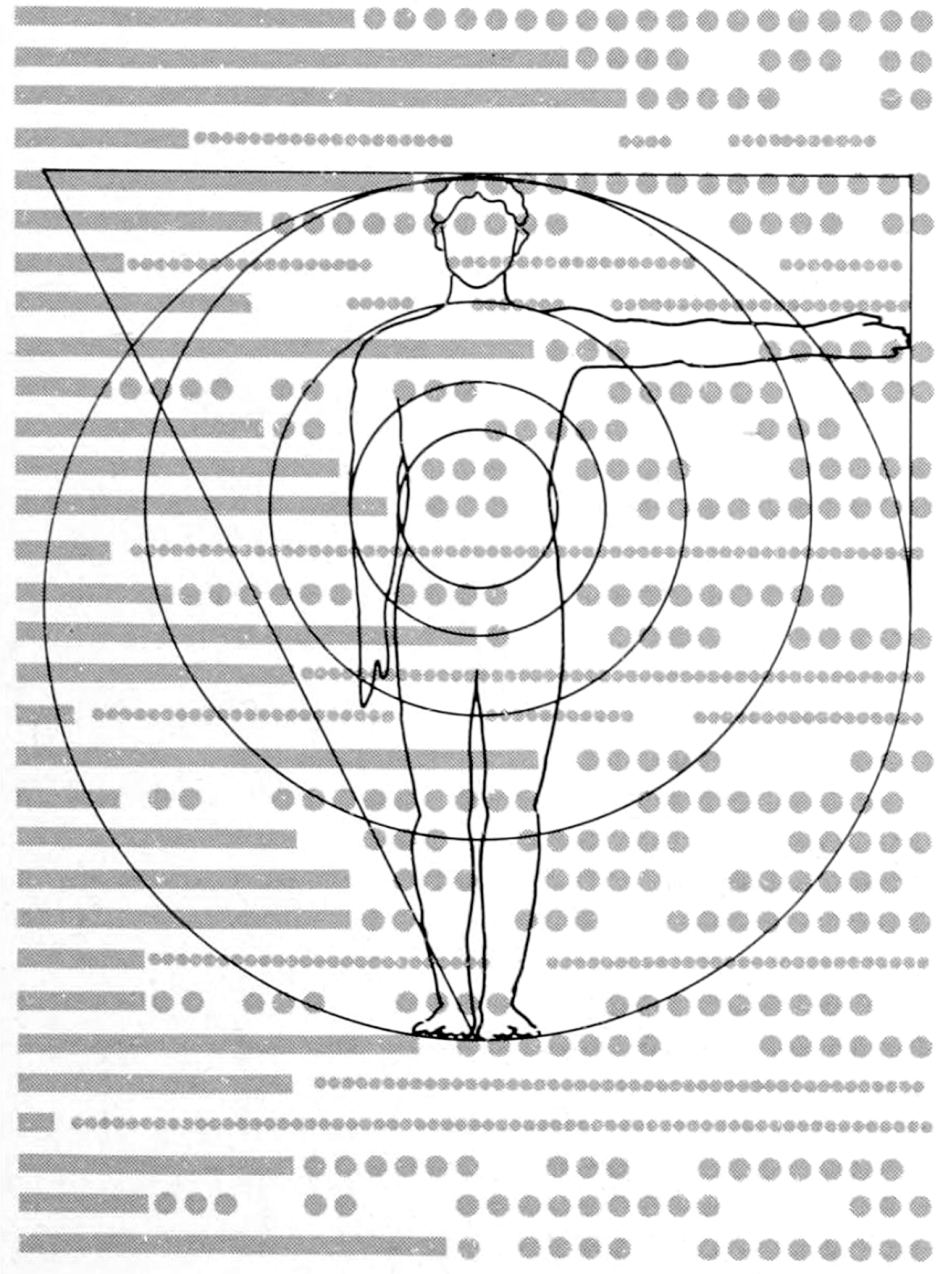


Fig. 8: Esoteric role of the CBC system, as envisioned by Norconsult. Norconsult booklet, 1977.

rational modernity in post-independence Zambia, a promise readily accepted by the Zambian state representatives.

In 1977, after the project had been extended three times, the Zambian Ministry of Education put together an evaluation team of twelve professionals, four of whom were Norwegian.[105] This was a watershed moment for the project: the evaluation was so negative that Norad was determined to keep it from becoming public.[106] Quite tellingly, Zambian participants of the evaluation team were far less critical towards the project than their Norwegian and other Western colleagues.[107] Looking back, the report indicated that since the client did not have any prior knowledge of the CBC system, they 'did not express any serious doubts about its use'. The modular building system was deemed 'reasonable', and the decision to implement it did not cause much tension at the planning stage.[108]

Indeed, for the Zambian representatives, the project initially promised a new, modern way of building, a radical upgrade of existing technologies of construction. If, according to Hui, cosmotechnics represents a unification of the moral and the cosmic order, the choices made by the Zambian political elites already stemmed from the imported Western cosmic order of capitalism, and this allegiance can easily be detected in countless archival documents. Indeed, the values, goals and means of post-independence political elites are often already in conflict with local traditions and the understanding of technology.[109] Marco Pavanini, in his discussion of cosmotechnical pluralism, offers an alternative to the homogenising order of Western capitalism, without ascribing it solely to the low-cost paradigm. To discover its own set of cosmotechnics, a culture would need to perform a deep dive into its own cognitive structures, techniques and technologies.[110] If, following Ani Loomba, the prefix 'post-' refers to supplanting ideological structures, the Zambia school project did not yet rely on post-colonial computing.[111]

Some of the Norwegian architects – a post-1968 generation – were well aware of these dynamics. For example, for many participants, it was clear that the decisions taken by Norwegian consultants abroad 'were based on the sixty years of belief in technology and rational industrial solutions for the developing countries.'[112] Architect Torstein Ramberg, in his contribution to the 1977 seminar on the role of architects in development aid, argued that Nordic specialists 'have the instinct to transfer out technology to others, without considering the direct influences and side effects of this technology in the receiver country.'[113] And while the transfer of the most modern technology seemed to be an effective solution in the short term, it brought problems of continuity and maintenance, since ultimately, most of the imported technology was unsuitable for local conditions. Instead, Ramberg suggested that planners and architects should have been thinking more long-term and base projects on local values and technology.[114] Indeed, towards the end of the 1970s, problems of technology transfer, seen in the light of emergent environmental concerns, became central to critical discussions in the profession. Such discussions on the originary nature of cosmotechnics reflect the benefit of a critical distance, which was not always applied at home.

The genealogy of the Zambia World Bank Education Project reflects the complex paths of cosmotechnical transfer. Following the patterns of former colonial influence, Norwegian engineers imported a set of more 'advanced' cosmotechnics from Denmark. Much of the post-war Norwegian debates on prefabrication were shaped by the British experiments, and not least by the CLASP school system. And while hardly applied at home, these technological ideas were transferred again to Zambia, with a tangible architectural impact. As Joe Nasr and Mercedes Volait argue, decolonisation did not always mean the end of the export or import of ideas, but rather a blurring of the primary linear axes by increasingly complex transnational patterns of dissemination.[115] The import and integration of different cosmotechnics to Zambia presents a good case study. Although British colonial actors stepped down, bureaucratic structures and their established cosmologies persisted. The Department of Public Works maintained what Peter Scriver has called 'departmental thinking', where standardisation and computerisation promised more control in the design process.[116] Norwegian experts lent not only credibility but also a technical framework to a large post-independence showcase of Zambian governmentality. The 'Wild Bank' Education Project amalgamated the interests, rationales and cosmotechnics of different actors that shared responsibility over technological decisions.[117]

Despite incessant criticisms of the project's design and implementation, its architecture received little attention. Listing the project's drawbacks, the 1977 report only mentioned issues with ventilation gaps, the wrong positioning of chalkboards, and insufficient sound insulation between classrooms. Some teachers complained about the unconventional roof structure; others, however, admitted that they provided the project with its distinguishing character. Classroom units were considered adequate, and the new assembly and dining halls were spacious. 'On the whole, the science teaching facilities provided under the Zambia World Bank Education Project are satisfactory', concluded the evaluation report.[118] This note poses a question about the indeterminacy of architecture. If the technology and the principles of the project had so many shortcomings, how was the architectural production so satisfactory in the end? The project was planned within a brief period of promising prosperity but was implemented during years of political

and economic turmoil. The system – or its execution – was flexible enough to adapt to these changing conditions. In the end, the cost of construction was exceeded by only 14 per cent, although the cost of technical personnel ended up three times higher than originally predicted.[119]

The Zambia World Bank Education Project was, indeed, a project of wild ambitions. Negotiating the many often-competing agendas and interests, the project provided more than twenty-four thousand new educational spaces nationwide.[120] However, this was neither a story of imposed technology and expertise that ultimately failed, nor a story of good intentions in a country that was not ready for the technology. Rather, the Zambia World Bank Education Project and its many problems offer an insight into the complex (and often competing) nature of cosmotechnics. This study, however, is not exhaustive and serves as a first step towards further inquiries into a cosmological understanding of technologies and their application in architecture.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Notes

1. Norman Taylor, 'Zambia World Bank Education Project Progress Report no. 1977/2 & 3, 1 April 1977 to 30 September 1977', 'Introduction and General Remarks' in Box Eaa-L0592, Series RA/S-6670/E/Ea, Norad Archive, National Archives, Oslo, Norway.
2. Geoffrey Moorhouse, *The Fearful Void* (London: Faber and Faber, 2011).
3. See a brief popular explanation in James Stokley, 'Celestial Coordinates', *Science News* 100, no. 13 (1971): 217, https://doi.org/10.2307/3956426.
4. Taylor, 'Project Progress Report no. 1977/2 & 3'.
5. Norman Taylor, 'Zambia World Bank Education Project: Quarterly Report for the Period 1 April to 30 June 1978', Lusaka, 30 June 1978, Box Eaa-L0592.
6. 'NORADs vurdering av rapporten – Vedlegg' (Norad's evaluation of the report) (1977), 1, Box Eaa-L0594, Series RA/S-6670/E/Ea.
7. Ibid.
8. See a letter from Olav Myklebust to Jon Aase regarding Meland on 28 January 1970, in Folder 'Personell', Box Eaa-L0594; or a later letter from Tormod Førland to Norad on 19 April 1976, Box Eaa-L0593, all in RA/S-6670/E/Ea.
9. The term 'cosmotechnics' is discussed in depth in the themed edition of *Angelaki:* Yuk Hui, 'Cosmotechnics', *Angelaki* 25 (2020): 4, 1–2, https://doi.org/10.1080/0969725X.2020.1790828.
10. Latour refers to bureaucratic documents as 'the most despised of ethnographic objects'; Bruno Latour, 'Drawing Things Together', in *Representation in Scientific Practice*, ed. Michael Lynch and Steve Woolgar (Cambridge, MA: MIT Press, 1990), 54. See also Matthew S. Hull, 'Documents and Bureaucracy', in *Annual Review of Anthropology*, 41 (2012): 253. Ben Kafka argues that until very recently, bureaucratic documents had been *looked through* by researchers but seldom *looked at;* Ben Kafka, 'Paperwork: The State of the Discipline', *Book History* 12 (2009): 340–53.
11. Among people over sixteen years old, 75 per cent of men and 95 per cent of women could not write. Meeting note no.3/69 from 21 April 1969; Folder '311.11 Forhåndsdrøftinger, Generelt', Box Eaa-L0595, RA/S-6670/E/Ea.
12. 'Avslutningsdokument: Zam 003-Høyere Skoler' (The Final Document: Zam 003-High Schools), 16 March 1982, Box Eaa-L0596, Series RA/S-6670/E/Ea.
13. World Bank, Report no. 4508, 'Project Performance Audit Report: Zambia First and Second Education Projects (Loans 592-ZA and 645-ZA). 20 May 1983', 'Principal issues', 5. For a brief history of British 'manpower planning' see A. R. Smith and D. J. Bartholomew, 'Manpower Planning in the United Kingdom: An Historical Review', *The Journal of the Operational Research Society* 39, no. 3 (1988):

241–43, https://doi.org/10.2307/2582606; Patrick D. Lynch and Maritza Tason, 'Research on Educational Planning: An International Perspective', *Review of Research in Education* 11 (1984): 307–67, https://doi.org/10.2307/1167238.

14. A letter about the loan agreement and the educational project from the Republic of Zambia to the World Bank, 1 June 1969, Folder 4, 'Avtaler Zambia-Norad', Box Eaa-L0596.
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19. John Trygve Lundeby, 'Bygg og vedlikehold i Afrika' (Construction and maintenance in Africa) (Master's diss., Oslo University, 2005), 27; Jones, *World Bank Financing,* 76.
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21. 'Avslutningsdokument', 16 March 1982, Eaa-L0596.
22. Ole Bernt Frøshaug, *Utviklingshjelp i 25 år: 1962–1987* (Oslo: Departementet for utviklingshjelp, Informasjonsenheten, 1987), 5–7.
23. Norad, *Dette bør du vite om norsk u-hjelp* (This is what you should know about Norwegian aid) (Oslo: Norad, 1978), 8–17. For more on the 'official' principles, see 'Nordiska Rådet. Medlemsförslag. A 484/e', Box Xa-0010 Nordisk Samarbeids råd, in RA/S-6306/X/Xa, Departementet for utviklingshjelp archive.
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33. Lundeby's interview with Halvor Fossum on 11 September 2003, ibid.
34. Ibid. Halvor Fossum, a letter to Norad, 28 October 1968, Box Eaa-L0595.
35. Fossum, a letter to Norad, 28 October 1968, Box Eaa-L0595.
36. Meeting note no.3/69 from 21 April 1969, Box Eaa-L0595.
37. As Lundeby writes, at some point Norconsult was better informed about the project than NORAD, while Norconsult engineers entertained the Zambian delegation for the entire duration of their visit in November 1968. Lundeby, 'Bygg og vedlikehold', 30–31.
38. A letter from S.J.G. Burt, Chief, Division I Educational Projects Department (World Bank) to Mr. D. Mulaisho, Permanent Secretary, Ministry of Education, 5 June 1969, Box Eaa-L0595.
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94. ‘Progress Report for 1st Quarter 1974’, 1, Box Eaa-L0592.
95. See descriptions of the situations of Cohen & Co Ltd, Brunelli Construction Ltd, Prago Builders and ZECCO, and Energoprojekt: ‘Progress Report for the 2nd Quarter of 1976’, 1, Box Eaa-L0588; ‘Progress Report for 1st Quarter, 1975’, Box Eaa-L0590.
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Biography

Maryia Rusak is an ETH postdoctoral fellow (2022–24) at the Chair of the History and Theory of Urban Design of Tom Avermaete. Her postdoctoral project investigates the Nordic architecture of foreign aid in postcolonial Africa, focusing on the pragmatic economic rationale behind architectural production. Prior to joining gta in 2022, Maryia completed her PhD at the Oslo School of Architecture and Design. In her research, Maryia is particularly interested in histories of everyday objects, webs of bureaucratic institutions, obscure intricacies of architectural production, and generally, how buildings are made. Her recent research has explored postcolonial narratives across cultural and geographic divides. Rusak holds an MArch in Sustainable Urban Planning and Design from KTH, Stockholm, and a BA in Architecture from Princeton University.

The Sea Wall and the *Kampung*: A Debate on Architectural Cosmotechnics

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Abstract
We propose that architectural responses to planetary environmental challenges are a crucial domain for cosmotechnical action. We explore the possibilities of cosmotechnical design by analysing two contrasting responses to the effects of anthropogenic climate change in Jakarta: defensive sea-wall construction and adaptive community action. Jakarta is an essential case for exploring cosmotechnics: a world city at the forefront of planetary environmental challenges, and a capital with a conflicted urban history, deeply shaped by colonisation and by its immersion in global circuits of capital and trade.

Keywords
Cosmotechnics, climate change, geo-engineering, territory, kampung

What is cosmotechnics for? And where does it work?
In *The Question Concerning Technology in China: An Essay in Cosmotechnics*, Yuk Hui explains the key condition where his proposed notion of cosmotechnics works: the Anthropocene – a planetary context that Hui reads as the universal imposition of technical modernity and global capitalism.[1] By defining cosmotechnics as the 'unification of the cosmic and moral order through technical activities', Hui seeks to counter the understanding of technology as an autonomous realm devoid of ideological content and implementable in any context across the world that has underlaid the emergence of the Anthropocene.[2] To the hegemonic technologies driving capitalist globalisation, Hui counterposes the possibility of creating a diverse and ecologically thriving world, characterised by technological plurality. In this sense, as Hui has repeatedly stated, cosmotechnics is, above all, a tool for planetary thinking.[3]

But Hui is also conscious that his proposal joins a dense and contested landscape of concepts seeking to reconfigure our forms of operating in the Anthropocene. In particular, Hui polemically situates cosmotechnics as a way to transcend the two contrasting ideological poles that are structuring most debates on the Anthropocene. On one hand the 'eco-modernist' thesis, which understands solving the ecological degradation produced by global capitalism as only requiring more technological ingenuity: new, cleaner, global eco-friendly technologies, hyper-efficient fabrication methods, green algorithms coupled with AI-powered data-science, or, why not?, geo-engineering. On the other hand, the position championed by the 'ontological turn' in Anthropology and the critical humanities, which states that to overcome our planetary ecological crises we need to radically abandon the modern conceptual edifice and its associated ways of categorising the world.[4] Without a doubt, Hui is critical of the eco-modernist approach. And yet, cosmotechnics is also, decidedly, an

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instrument to overcome the shortcomings of the ontological turn.[5]

Anthropologists Eduardo Viveiros de Castro, Marisol de la Cadena, Bruno Latour and Philippe Descola are some of the major 'ontological turn' thinkers. For Hui, Descola is a particularly crucial figure. In the same way than Hui's cosmotechnics posits that there is not a single technology, but a plurality of technics, Descola considers that there is not a single nature, but four types of human-nature relations, four 'ontologies': animism, totemism, naturalism, and analogism.[6] Of these, only naturalism corresponds to the dualistic split between culture and nature that dominates Western thought, whereas the rest characterise non-Western and indigenous societies. This idea of multinaturalism motivates ontological thinkers' central thesis: our current ecological crisis is the result of Western mononaturalism's forced conversion of the plural world into a universe. Their goal is to challenge this universalist framework by recuperating the multinaturalist logics of non-modern communities, fostering a world populated by a multiplicity of groups, each with their own, distinct ontology. For the ontological thinkers, there is neither a single humanity nor a single nature, but a plurality of life-worlds.

Hui certainly appreciates the ontological turn's pluralistic attitude: cosmotechnics also seeks a plurality of techniques. However, there are key divergences between cosmotechnics and multinaturalism. Hui is sceptical of the fascination with non-modern indigenous ontologies as viable alternatives to modern technology. He considers that modern, Western technology has so deeply shaped societies across the planet that there is no return from its effects. Similarly, he criticises the identitarian ideology of localism pervading ontological discourses, and its potential risks of 'metaphysical fascism'.[7] For Hui, the value of locality derives from its capacity to trigger new planetary forms, rather than from having an intrinsic value as an independent life-world.[8] Moreover, Hui comes close to eco-modernism by affirming that it is not possible to elaborate non-technological responses to the Anthropocene. Premodern solutions do not solve global challenges. The goal of cosmotechnics is thus to build upon the existing planetary technologies, by diversifying their forms and, crucially, by rethinking them as constituents of new reconciliations between the moral and the cosmic.

This attempted reunion of the cosmic and the moral via technology brings us to a last, key conceptual difference between Hui and the proponents of the ontological turn. The latter have articulated another major critical concept to operate in the Anthropocene: cosmopolitics.[9] Understood mostly as a branch of political ecology, cosmopolitics considers that interventions modifying ecology and environment should be the drivers of political debate between the different communities affected, each representing a different ontology. The hope of cosmopolitics is that the debate between these contrasting life-worlds would result in agreed solutions which, instead of extending once more the universal hegemon (that is, 'capitalism') would reconcile the needs and cultures of those involved. The planetary addition of all those local debates would result in a pluriverse, rather than in the supposedly existing, Western dominated, universe.

Hui's emphasis is on technics and poetics, not on politics. This techno-poetic character has a strong spatial component. When Hui talks about the technical integration of the cosmic and moral orders, his understanding of the cosmos is explicitly geographical or spatial. His constant point of reference on this aspect is Gilbert Simondon, whose book *On The Mode of Existence of Technical Objects* is a major theoretical inspiration. In it, Simondon traces the historical emergence of technicity in order to reveal how technical systems originate in relation to a geographical milieu and constitute a means to structure or 'reticulate' geography, imbuing it both with spatial order and cultural meaning. Cosmotechnics is a contemporary attempt to rehabilitate this vision of technology as a tool to culturally and spatially structure geography into a 'techno-geography'. Following Simondon, Hui understands that technics turns the geographic 'ground' into a 'figure'– only now, the geographic figure becomes a planetary one.

This contrast between cosmotechnics and the pair cosmopolitics-anthropological turn brings forward two major consequences of Hui's thinking for urban design. The first is his scepticism towards strictly local life-worlds and technics, and his interest in exploring how local and 'modern' technics inform each other to generate a different form of building the Anthropocene. The second consequence is Hui's inattention to the political procedures that are at the core of cosmopolitical practices, and his alternative emphasis on the role of technology to articulate our planetary, geographic milieus. Hui declines the political as a cosmotechnical question.[10] For him, the key to an alternative shaping of the cosmos is a new, pluralistic way of technical thinking.

During the last decade, the ontological turn has led to several theoretical speculations on the possibility of 'cosmopolitical design', albeit with barely any actual impact on architectural or urban practices.[11] The conceptual changes Hui proposes – going from the ontological privilege of a diversity of natures to the privilege of a diversity of techniques, from the emphasis on non-modern life-worlds to a possible convergence between modern and non-modern techniques, from the political to the geographic – may suggest valuable paths to overcome the cosmopolitical impasse. And yet, this possible approximation between

architecture and cosmotechnics must also contend with the fact that architecture is not merely a technology, at least not in the sense that Hui prioritises (machines, digital systems). Architecture is usually motivated by several layers of cultural, formal and spatial intentionality that exceed mere technical rationality and impede equating architecture to technology. As a result, we cannot simply assert that architecture *is*, at all levels, a cosmotechnics. We can, however, adopt a more partial approach: to interrogate what particular areas of architecture can be relevant *as* a cosmotechnics. As Hui has himself done by thinking art *as* a cosmotechnics, we can use cosmotechnical reasoning to interrogate, and develop some crucial dimensions of architectural production.

We propose approaching architecture as cosmotechnics through two main conceptual moves. First, by singling out as an object of reflection those aspects of the architectural practice with a determining technical component. In this sense, cosmotechnics becomes a call for deeply rethinking architecture's technical logics. Second, by paying special attention to those architectural technics directly involved in the response to planetary challenges. In the same way that Hui's recent writing focuses on cybernetics and programmability, because these are key technical dynamics shaping contemporary planetarisation, we propose that the crucial realms for cosmotechnical thinking are those architectural, urban or territorial interventions that need to contend with, and shape, planetary phenomena; primarily, climate change.

Our point of entry to explore the possibility of architectural cosmotechnics is to discuss contrasting architectural strategies responding to sea-level rise: defensive sea-walls and flexible adaptation. Our space to do so is Jakarta, a multifaceted case for cosmotechnical analysis: a world-city at the forefront of the Anthropocene's environmental challenges; a capital with a conflicting urban history, deeply shaped by colonisation and by its immersion in global circuits of capital; a human geography that pressingly needs to contend with the combined effects of sea-level rise and land subsidence.

Jakarta is, in fact, the scenario of contending visions to address the Anthropocene's effects. The national administration intends to protect the city by building a kilometric sea wall, accompanied by a huge coastal urban development. In this project, we see at play the implementation of well-settled technologies of coastal protection, refined during modernity, and which are being implemented worldwide to avoid coastal flooding. Alternatively, Jakarta is also the site of hundreds of *kampung*s. These are semi-autonomous 'villages', often built without state support, that respond to sea-level rise through a changing, flexible relation to the aquatic medium that is at the centre of the residents' social and economic lives. Through the Sea-Wall and the *kampung* we can debate how contrasting techniques of environmental response can become potential components of an architectural cosmotechnics, components whose relation is not necessarily either/or, and which may have the capacity to articulate, anew, our geographic milieus.

The technical organisation of Jakarta's hydrological systems

Jakarta is a city severely affected by climatic hazards, threatened by water from two sides: the sea in the north, and its overwhelmed rivers carrying water from mountains to its south. A significant part of the city is built under sea level, occupying the space of a delta where thirteen rivers converge into Jakarta Bay. The intense monsoon rains, coupled with the difficulties of drainage, causes frequent flooding of significant areas of Indonesia's capital. The city's worst inundation, in 2007, affected more than 300 000 inhabitants, while similar events had already happened in 2002 and 1996.[12] The flood risk is only exacerbated by anthropogenic climate change. The possibility of torrential floods has increased, and the expected sea level rise will augment the possibility of flooding from the sea. As a result, protecting the city from flooding has become a logical concern for Indonesian authorities.

The city's responses to flooding are heavily influenced by its colonial history. The Dutch colonisation of Indonesia resulted in a complete modification of Jakarta Bay's environment, and in the creation of the system of water management that still characterises the contemporary city. Prior to the arrival of the Dutch, indigenous populations situated their settlements on higher terrain, reserving the delta's marshy, flood-prone areas for agriculture.[13] This techno-geographic logic was neglected by the Dutch East India Company, whose dominion over their own low-lying coastal deltas emboldened them to settle at the mouth of the Ciliwung River.[14] The fort of Batavia, the germ of current Jakarta, was built directly on the coast as an export-oriented port-town. To tame the delta's volatile hydrological conditions, the colonists relied on the technical logics formed in their own milder, more compliant environment: by the early seventeenth century, the bay's rivers and their tributaries had been transformed into a system of canals.[15] The limitations of this technic of water management in a new geographical context and a forbidding tropical climate soon became evident: mere canalisation was incapable of properly handling the water flows. Siltation was a recurring problem, often clogging the city's canals and rivers, while sedimentation complicated the port's use.[16]

Dutch Batavia turned into Jakarta after 1945, when the city became the capital of independent Indonesia.

Jakarta's massive urban growth is a post-colonial phenomenon. Between 1960 and 2010 the population grew from 2.7 to almost ten million people, turning Jakarta into one of the largest megalopolises in Southeast Asia.[17] This drastic growth has exacerbated the city's hydrological problems. The few remaining floodable buffer zones were occupied by settlements, while the ecosystems mediating between land and water, such as mangroves, diminished.[18] In addition, construction proceeded without piped water provision, leaving 53 per cent of Jakarta's population to rely on water obtained from private deep-water wells. Meanwhile, the reduction of permeable green areas from 40 per cent in 1985 to only 9 per cent by 2002 prevents the natural repletion of aquifers.[19] The consequence is an extended phenomenon of land subsidence. 40 per cent of Jakarta is now below sea level, and land subsidence rates range from three to twenty-five centimetres per year: a rate up to ten times that of sea level rise.[20]

We situate ourselves in a city affected by monsoon rains, land subsidence and the sedimentation of its canals, by climatic hazards and sea level rise. Can cosmotechnics help us rethink the city's response to these challenges?

The Sea Wall

The Giant Sea Wall. Or The Great Garuda. These two names popularised, in the international press, an ambitious project of geo-engineering with a less bombastic, more bureaucratic, official title: the National Capital Integrated Coastal Development (NCICD). The initiative was announced by the Indonesian government in 2014 to protect Jakarta from sea-induced flooding events, and contemplates enclosing a significant part of Jakarta Bay by building a thirty-two-kilometre-long dyke, parallel to the city's northern coast. [Fig. 1] Although the project has received justified criticism for its dramatic social, ecological, and economic costs, the construction of the sea wall still appears to many in the Indonesian government as the optimal solution to protect Jakarta. If built, the city would follow an increasing number of sites across the world that are building massive coastal barriers. Caused by a necessary concern with sea level rise and extreme climatic events, over the last three decades sea walls have increasingly become a global technology to protect land, implemented with similar technical procedures across different geographic and cultural contexts.

But protection may not be the only rationale behind the project. The NCICD culminates a series of previous projects to reconfigure the city's coastline. In the 1990s, Sukarto's authoritarian regime already proposed a massive land reclamation project for Jakarta Bay. Similar land reclamation measures were conceived during the 2000s, after Sukarto's resignation, and captured in the 2010–2030 Spatial Plan for Jakarta.[21] All these plans had ambitions to utterly transform the existing socio-spatial fabric of Jakarta's coast line (a mix of port and industrial activities, warehouses, and traditional stilt housing for the city's fishing communities) into the clichéd repertoire of the global city: business centres, leisure spaces, offices, and housing for the accommodated classes. The NCICD project would be the last, even more ambitious, turn of the screw. It is the excuse for an enormous urban operation to transform Jakarta into an eminent coastal city on the global stage. The design contemplates creating a freshwater lagoon between the existing city and the wall, and the construction of seventeen artificial islands full of new offices and housing, capable of absorbing two million people. Toll roads, a railway, a seaport and new beaches would top the operation, adding the necessary amenities and services to fulfil the well-established image of the global city.

Opportunistically, the NCICD's vision of a global city aims to adjust the expectations of transnational capital to local mythology, thus replacing the existing inhabitants of the area by their presumed beliefs. The NCICD replicates previous coastal projects in Singapore, Shanghai and, especially, Dubai. Since the fall of the Berlin Wall, architects helped build the image of neoliberal globalisation by distributing interchangeable architectural icons across the world. Dubai's waterfront initiated a new inflection of this global trend. The iconic character of the buildings was translated to the urban plan: its well-known islands compose figurative images of palm trees and planispheres. The Jakarta project replicates the operation on an even larger scale. Seen from the air, the sea wall and the islands form the image of a Garuda, Indonesia's mythical bird and national emblem. Mythology is instrumentalised to reconcile the transnational needs of the global city with local traditions, while also producing a capital-attraction image, consumable worldwide.

Sea walls are a millennial technology that has been thoroughly refined in the last one hundred years, thanks to the perfection of engineering methods and the better understanding of coastal behaviour. In this period, sea walls became a global technology, increasingly needed to protect urban areas from sea level rise. Their construction has gone hand in hand with the consolidation of global nodes of engineering expertise, capable of exporting their technical know-how. The NCICD is a collaboration between the governments of Indonesia and the Netherlands – the former colonising power, and the country responsible for Jakarta's existing, problematic, system of canals – but the project was entirely designed and largely financed and managed by Dutch corporations. Backed by the state, Dutch engineering firms present themselves as experts on dyke-construction, an affirmation sustained by the

Fig 1: Visualisation of the NCICD plan. Image: Kuiper Compagnons.

country's successful history of protection from the North Sea. The model for the NCICD is the 1932 Afsluitdijk, the Netherlands' longest dyke, whose length of thirty-two kilometres matches Jakarta's wall exactly. In the NCICD we thus see the conflation of some key aspects of neoliberal globalisation. Global engineering expertise, coupled with globalised technology, aimed at the production of global cities, whose new plans and constructions circulate across the planet as symbolic, easily consumable images.

The NCICD is not the most efficient way to solve Jakarta's flooding problems, or the best response to their urgency. The heavy monsoon rains, and the incapacity of the heavily sedimented, colonial-era canals to channel the same volume as the older rivers had been, cause floods that are not related to the sea. Jakarta's land subsidence is equally independent from sea-level rise. The lowering of the terrain and the insufficient drainage won't be solved by the sea wall. Solving those issues requires technical measures such as building a city-wide water infrastructure to avoid ground water extraction, implementing efficient measures to reduce the waste and sediments deposited in the canals, and increasing the permeable surfaces for water absorption. Such measures are more urgent than the construction of a sea wall.

In addition, local critics of the project have correctly highlighted the devastating ecological and social transformations the NCICD would produce. If built, the intervention would turn a vast area of Jakarta Bay into a freshwater reservoir, eliminating the area's biodiversity and the few remaining mangroves that have survived urban development, themselves a natural protection against sea-induced floods. The NCICD would also suppress the fishing livelihoods of a significant part of Jakarta's communities. As a result, the project would cause the eviction of the existing communities, whose lives are fundamentally linked to the sea, to be replaced by citizens who can afford living and working in new, upper-class islands. Ultimately, the need for protection masks plain and simple gentrification.

We fully support these criticisms, and the need to utterly rethink the NCICD. And yet, in the light of the expected sea level rise and associated climate change, the future need for a sea wall may remain. While the city should prioritise the measures to avoid land subsidence and increase the canals' draining capacity, the expected increase of cataclysmic sea-related hazards may support the idea of building a sea wall to protect a vast city in which radical measures such as abandoning flood-prone areas seem impossible to execute. If that is the case, how could the construction of a sea wall be approached differently?

Dipesh Chakrabarty has suggested that the emergence of a 'geological consciousness' derived from anthropogenic climate change implies the coming 'of a point in history where the global discloses to humans the domain of the planetary'.[22] The NCICD is a clear example of a globalised construction ethos, mobilising transnational engineering expertise to produce capital-driven global imaginaries. Yet, can the need for environmental protection, characterising life in the Anthropocene, be altered to play a cosmotechnical role? Can a globalised technology responding to planetary challenges be turned into a cosmotechnical one?

Indonesia is the largest archipelago in the world. Its culture and livelihoods have historically maintained an intense relation to water. This intensity of relations is captured by the Indonesian term *tanah air*, whose literal meaning, 'land-water', translates into English as 'homeland' and is used to refer to the entire archipelago.[23] We see, in this notion, an entanglement of biophysical media and social conditions, rather than a clear distinction between them. Across the archipelago, few places are considered truly 'inland' and so a large part of Indonesia's communities have a meaningful connection to the coast, in Indonesian, *pantai*. This is a highly polysemic term. In addition to meaning coast and beach, *pantai* also expresses, in Abidin Kusno's words, cultural and political 'aspirations for connection, integration and expansion' coupled with the 'pre-national "oceanic feeling" of Southeast Asia and the Pacific Rim at a time when the maritime polity united all the islands and waters in the region'.[24] For its part, Jakarta historically maintained a close relation to its beach (now disappeared) and to the bay's Thousand Islands, severed due to metropolitan growth. This relation has been both cultural and economic, and is still present in the fishing communities that currently inhabit the city's coast. Any cosmotechnical project in the bay should elevate these multiple relations to the sea.

Historically across the world, walls have been an essential instrument to define urban and architectural boundaries, structuring the relation between human artifice and nature. In Indonesia, the construction of stone walls mostly pertains to the domain of monumental architecture, rather than housing and villages; the wall's solidity marking permanence and importance. Also in Indonesia, the land taking rituals that used to precede the act of building served to create a system of geographic references, an overall frame each architecture then responded to.[25] Walls marked and differentiated space, and carried with them the capacity to order or, in Simondon or Hui's words, reticulate, geographic space. They constitute, following Gilles Deleuze and Elizabeth Grosz's geological reading of art, keyframing mechanisms, while frames are 'what establishes territory out of the chaos that is the earth'.[26]

In the NCICD the construction of the wall is the primordial hidden gesture, the problematic technical operation carefully obscured by the superficial image of the Garuda.

Reacting against the appeal to mythology, the primary element of cosmotechnical reflection should be the consideration and problematization of the wall, taking it as the element that will regulate the cultural and social relations between land and sea. Focusing the design on the definition of the sea-wall replaces the NICID's character as an act of image-making. Instead, it pays attention to the wall's role as an element that will define the area's social and ecological conditions, and frame its geographic and planetary relations. In this regard, a cosmotechnical approach to the sea wall should prioritise this infrastructure's territorial and ecological performance as an element shaping the 'techno-geographic milieu', rather than image-making.

The mythological reference to the Garuda strictly operates at the level of the plan view. The cosmotechnical approach to the sea wall requires, in turn, a careful understanding of the project's section in order to treat the infrastructure as a *tanah air*, land-water mechanism. Defining the project's section implies considering the sea wall's construction methods, its materiality, the possible coexistence of hard and soft engineering techniques and, crucially, its potential permeability to sea water, something Dutch engineers are about to implement in the Afsluitdijk, and that would allow the preservation of part of Jakarta Bay's ecosystem and the livelihoods of existing fishing communities.[27] This approach to the project also necessitates extending the section geographically, well beyond the wall, to trace the infrastructure's relation to the area's geology, bathymetry and ecology. The geographic section is a tool to measure the wall's functional and visual behaviour. It serves to calibrate the relations between city, wall and horizon, and to frame the ways in which communities can elaborate new ways of accessing the sea. The Garuda-shaped NCICD is a nationalistic emblem operating in plan. Cosmotechnics can promote a planetary-oriented element, operating geographically and in section.

Undoubtedly, a project like the NCICD is more than its section. Our emphasis on this infrastructural element comes from its being the project's technical core; the concealed nucleus from which the rest of the urban operations emanate. Cosmotechnics allows us to deeply question the generic technical rationality behind the project, and to open up new possible entanglements between culture, space and society. The current construction of the wall, and the the clear-cut divisions it produces between land and sea, between fresh and sea water, represent globalised technical methods that are being similarly implemented worldwide. The cosmotechnical interrogation of the seawall's section opens a door to rethink the Jakarta Bay project, but also begins to probe similar infrastructural projects across the world.

The *Kampung*

The term '*Kampung*' has no direct translation in the English language. It is often loosely translated as 'village', with connotations of rural or peri-urban contexts that have limited contact to modernity. In certain political rhetoric, 'kampung' is synonymous with 'slum'. In the case of the international coverage of Jakarta's environmental challenges, 'kampung' is used to refer to poor, over-populated, 'informal' urban settlements. In fact, a kampung is a heterogeneous category of settlement that more closely describes its social organisation and underlying cultural mores, rather than any particular architectural form. In abstract terms, the kampung is a traditional mode of collective living that implies a deep relationship to one's community and one's environment. In a country that encompasses countless geographies, ethnicities and cultures, kampung mores represent a scarce few core values that resonate across the Indonesian archipelago.

Contemporary kampungs have their roots in historic agricultural communities: traditional kampungs governed by customary law, or *adat*, which guides the community's culture and moral structure.[28] Adat is closely related to the community's cosmology, forming the framework by which it understands the world and its place within it. Adat life-worlds are frequently described as 'indigenous', however, already contested notions of indigeneity are particularly complex in the Indonesian context: most Indonesians are indigenous to their area, but given the thoroughly diverse make-up of the national population, even the most remote communities frequently take in 'local' migrants. Local organisations have instead adopted the term 'adat communities', which acknowledges the specific underlying social code rather than a reference to origin.[29] These sites are generally named 'kampung adat [area]', revealing the innate link between the kampung, as a settlement typology, and the social contract encompassed by adat.

While specific cosmological beliefs and adat laws vary across the archipelago, common threads span the entire nation. Broadly, adat communities have some version of a worldview that divides the cosmos into upper, middle and lower realms. Humans share the physical world (middle stratum) with other active and dynamic agents, including animals, earth; and importantly, water. This cosmology describes a relationship between communities and the world they share, with a distinct appreciation for Indonesia's geography, where natural elements (primarily earth and water) are often erratic and severe environmental events common.[30]

Notably, adat values assert three key community principles: flexibility, participatory engagement and mutual aid. These are legitimated by a worldview that acknowledges that nature is neither static nor unstable but behaves in

a predetermined, cyclical trajectory. There is an acceptance of the flow of nature and an understanding that it is resilient, as long as it is kept within the limits of its predetermined course. Adat therefore proposes a cooperative relationship between the community and its territory. Compliance to dynamic environmental cycles necessitates communal monitoring and encourages kampung members to participate in the evaluation of risk within the traditional agricultural system. Given the doctrine of mutual aid, kampung inhabitants can rely on a social code that distributes this risk throughout the community and will take individual action based on an assessment of particular social relations. [31]

Traditional adat practices of environmental management are exemplified by the Subak irrigation system of Balinese farmers. Here, rice farmers situate themselves within a cooperative socio-environmental system at the scale of the watershed. Harvest cycles are punctuated by adat rituals that entail collective environmental monitoring, resource evaluation and the synchronisation of agricultural activity. Subak farmers therefore conduct their agricultural operations based on a moral framework structured around spiritual, communal and environmental harmony, rather than purely for economic gain.[32] The Subak, therefore, is an ancient water management technic that aligns with the cosmic and moral order of adat.

However, it is important to note that adat also remains foundational to contemporary Indonesian ways of life. These social codes and moral order are exercised, to varying extents, by the full spectrum of the Indonesian population: from the most traditional adat community to the most reformed urban household. In this way, the kampung further subverts notions of indigeneity by disrupting its preconceived association with 'pre-modern' societies. This coexistence of contemporary conditions and adat practices distinguishes Jakarta's kampungs, some of them dating back to the seventeenth century, as sites offering distinctly Indonesian cosmotechnics.[33]

Jakarta is the site of hundreds of urban kampungs, composed of 'indigenous' Javanese and migrants from across the archipelago alike.[34] These take an array of architectural forms, having been assembled with various of amounts of capital and degrees of formal planning support from the local government. [Fig. 2] Given the historically aggressive commercial land development in Jakarta, its most financially vulnerable inhabitants have only been able to thrive on cheap, undesirable land. In fact, those kampungs at the forefront of Jakarta's environmental challenges are enabled by legislation prohibiting development on the fifty-metre selvage of the city's waterways.[35] This exclusion from the purview of commercial and administrative influence provides convenient parcels of land for growing kampung communities to settle by Jakarta's rivers, canals and shoreline. Here, informal kampungs do not have to compete with commercial land acquisition, but rather with the hysterics of an overburdened environmental system.

In an attempt to regularise the kampung into the administrative presence of the city, the Jakarta kampung has been absorbed into an otherwise Western model of urban administration. Officially, the kampung is interchangeable with the smallest administrative level of land: the *Rukun Tetangga* (RT), or neighbourhood.[36] This condition lends the kampung a partial autonomy, preserving a capacity for self-regulation and flexible coexistence with changing environmental conditions, including increasingly capricious flooding.

The urban *kampung*, like its rural village counterpart, is self-organised, administered by an elected RT chief who acts as intermediary between the residents and the wider world. The village chief's primary responsibility is to uphold the kampung's social code: *gotong royong* or 'mutual self-help'. This unwritten code is foundational to the Indonesian way of life, encompassing the adat principles of mutual-aid and flexibility. In the kampung, it drives a hybrid system of land tenure, which allows tenants to adjust their original plot boundaries with incremental, often unspoken negotiations. Though notions of ownership still exist in the kampung, flexibility in the practice of occupying space enables residents to temporarily adjust their spatial boundaries to accommodate personal, communal and environmental flux.[37] Similarly, adaptations to private property also frequently lend value to the community, such as easy evacuation points, raised platforms for community meetings and even occasionally bamboo supports to buttress more vulnerable homes.[38] [Fig. 3]

In this way, gotong royong is a tangible means of communal risk sharing, counter-balancing the potential for catastrophe during unpredictable climate patterns. In point of fact, many communities have been known to take cohabitation with climate risk into their own hands completely, communicating directly with watergate attendants to assess flood risks in real time, and acting through self-administered early warning systems at the local level.[39] These exploit contemporary technologies, such as WhatsApp, to foster collective consultation and action.[40] This brand of flexibility and mutual aid can be seen to be authorised by a foundation of adat cosmology. In this life-world, residents are motivated to help fellow community members weather (temporary) hardships, understanding that fates and fortunes take a predestined, cyclical course. Thus, the gotong royong social code's most valuable by-product is a culture of interdependence in increasingly uncertain environmental conditions, suggesting possible cosmotechnical paths to respond to anthropogenic climate change.

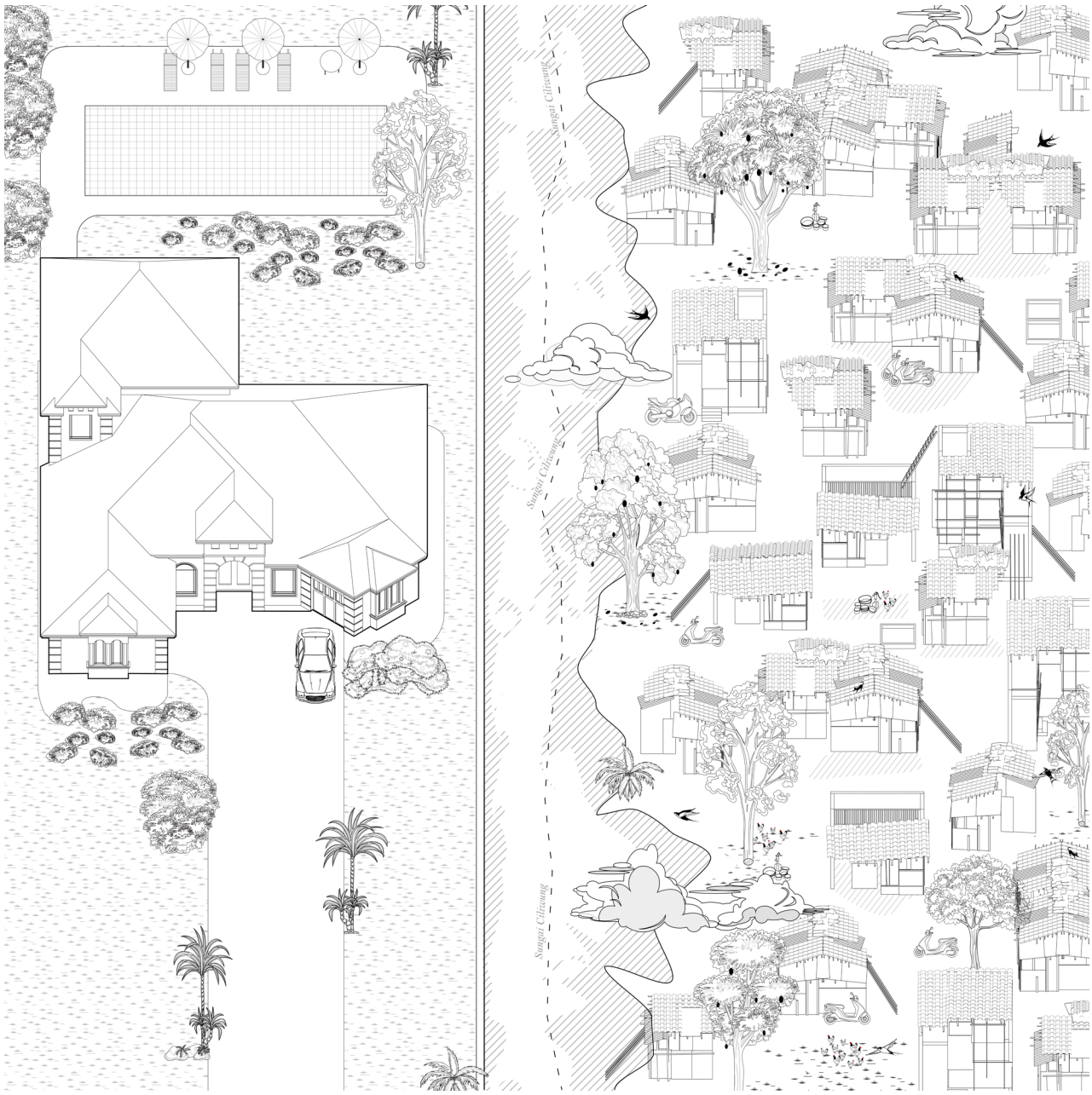

Fig. 2: Diptych of Jakarta's kampung and neighbouring gated community. Image: Sasha McKinlay.

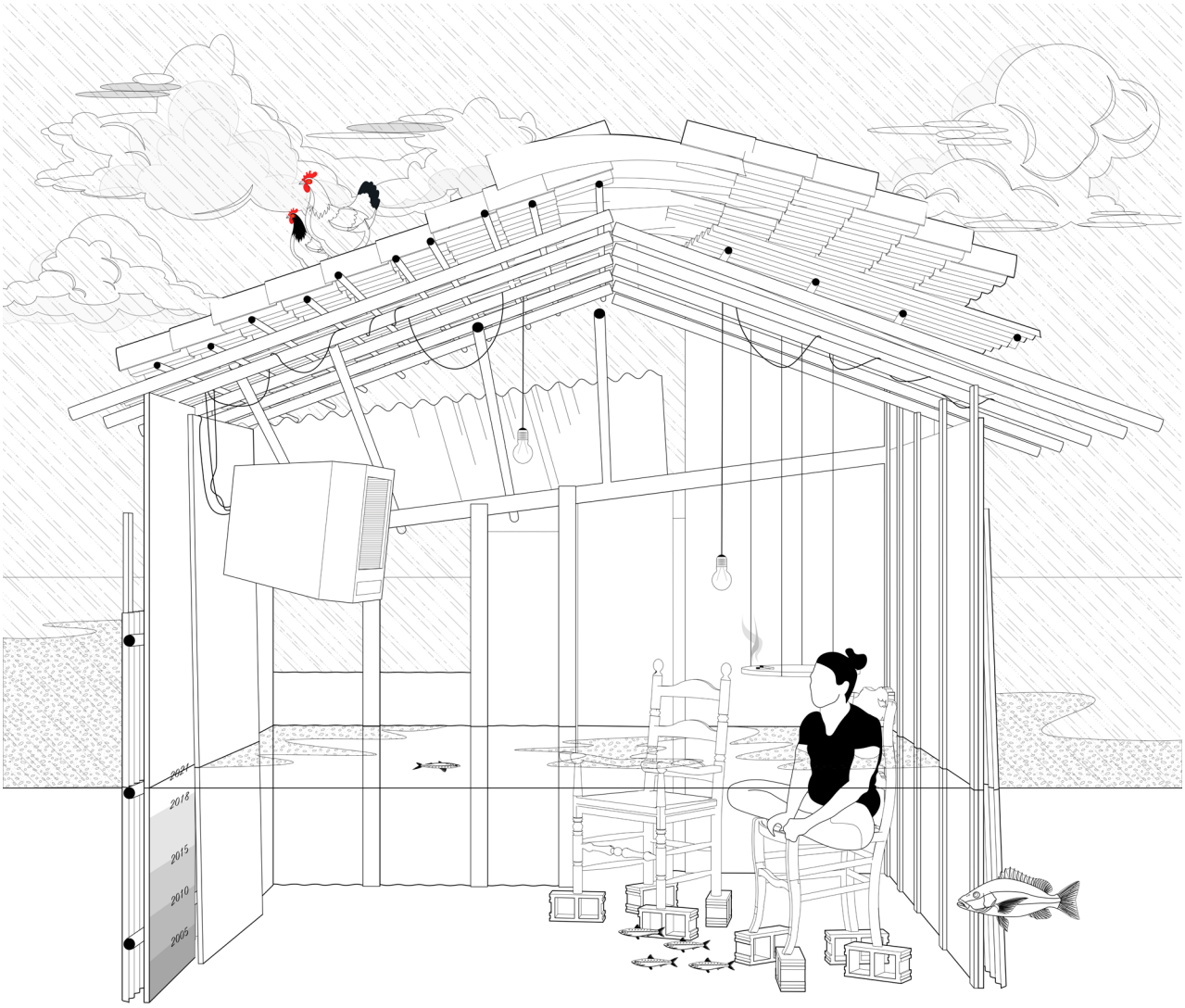

Fig 3: Gotong Royong system of mutual self-help in the kampung. Image: Sasha McKinlay.

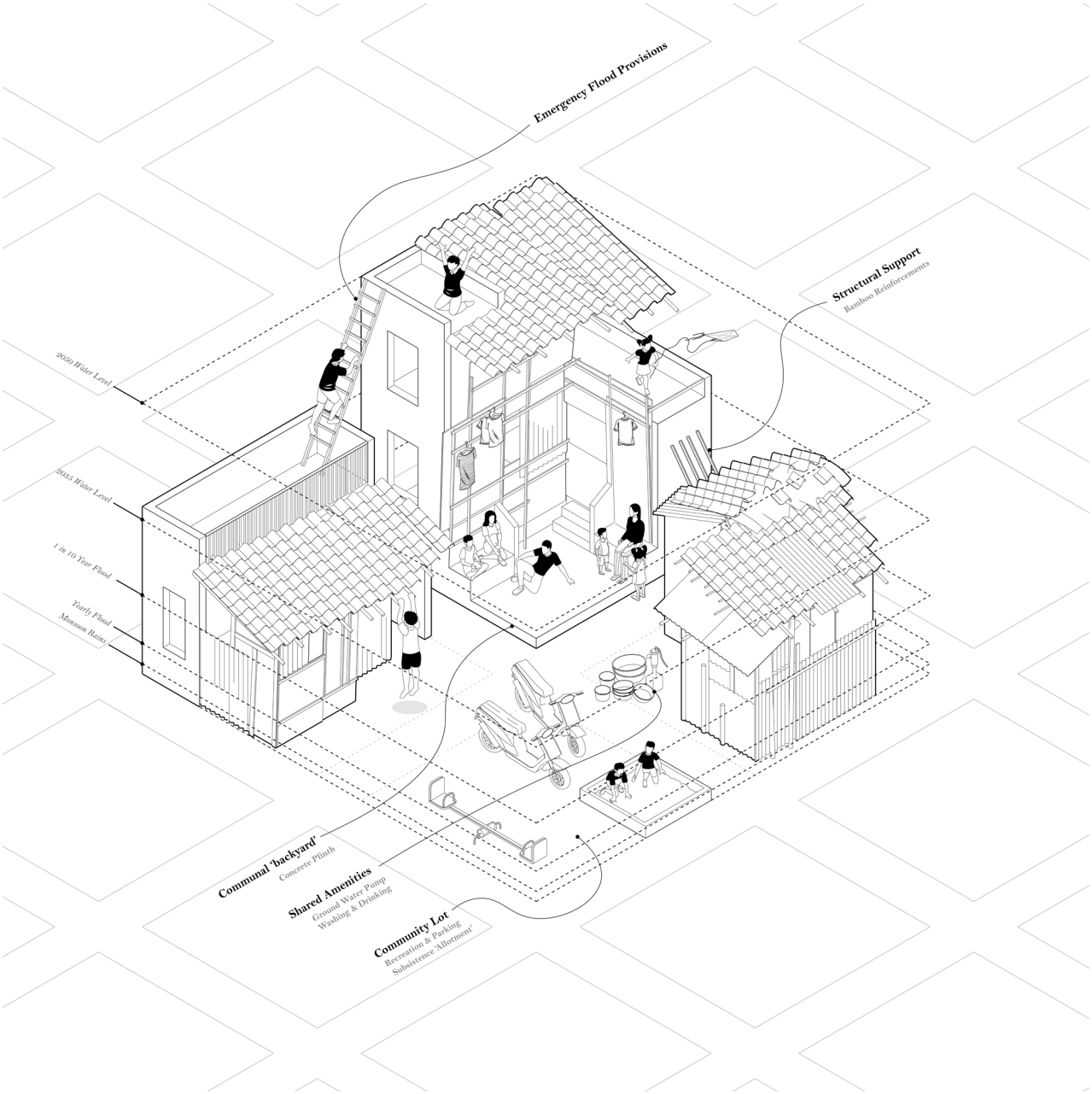

Fig. 4: Adat spatial hierarchy in flood-prone kampung homes. Image: Sasha McKinlay.

These kampungs are often ad hoc, patchwork constructions of plywood, corrugated metal and salvaged construction lumber. Homes may be raised on stilts, an architectural technic that harkens back to traditional adat kampungs. In a traditional kampung, settlements would organise themselves in step with the inhabitants' conceptions of cosmic order: elevating sacred spaces and allowing less important zones to lie below.[41] This arrangement occurs both at the scale of the settlement within its topography, and the home. It is this adaptation that is usually credited with passive climate control, sanitation, water management and protection from environmental disasters across scales of the vernacular kampung. Within its urban counterpart, the kampung's stilts have much the same effect. Raising the level of the home is a key adaptation adopted across Jakarta's kampungs, especially in response to flooding. It is also a well-known practice to keep and evacuate valuables to higher, drier zones of the house and the settlement, replicating a spatial order that closely resembles the traditional adat kampung.[42] [Fig. 4]

Many of Jakarta's rivers are fringed with stilted kampung constructions, homes balancing precariously over the edge of the river. Though natural waterways have largely been erased from the conventions of modern living, they are still critical to everyday life in Jakarta's waterside kampungs. Residents here will encounter their home waters daily as a space for washing, bathing, waste disposal and on the coast, fishing.[43] This profound dependence on land and water indicates a form of living that integrates a custodianship of the natural environment. [Fig. 5]

Indeed, Kampung community action has centred on environmental restoration of the river. In line with an underlying adat moral code, residents of the modern urban kampung continue to engage with environmental monitoring. Examples include conducting studies of fish species in the Ciliwung river, mapping industrial polluters across the watershed, and documenting land-use patterns along the bank. The urban kampung also demonstrates an inclination towards participatory engagement in addressing the pollution crisis of the water: organising regular river clean-ups.[44]

That said, the kampung has engaged in their own 'geo-engineering' projects. Kampung residents have been known to construct small dams and dykes, as well as platforms to lift public and private spaces away from the floods.[45] The key difference in these engineering adaptations are their alignment with an acceptance of natural flows. Kampung technics are centred on localised and temporary ways to manage the flow of water into their communities, using sandbags and compacted earth.[46] The fishing communities of Northern Jakarta also deployed rubble and mussel shells, widely available materials in their area, to raise a public coastal road and their homes, acknowledging the benefits of allowing the water to drain through and take their predestined course.[47]

Jakarta's kampungs offer a possibility of a cosmotechnical rationality, motivated by a shared moral order. Gotong royong can perhaps be simplistically described as a 'benefit-of-the-doubt' community posture and a 'margin-of-error' mode of occupying space. With negotiation and mutual understanding at the core of kampung culture, residents are better able to navigate unprecedented planetary challenges. Certainly, kampung adaptations are not blanket recommendations, but are demonstrations of technics deployed by an ethical logic in response to the kampung's tanah air, its earth-water. These 'techno-geographic' sentiments acknowledge the profound collective responsibility we have in the Anthropocene, to the environment and to one another.

Conclusions: a cosmotechnical debate

The sea wall and the kampung represent contrasting responses to the effects of anthropogenic climate change and, more broadly, of anthropogenic environmental modifications. They also represent different openings for cosmotechnical design. The sea wall is a more normative technical solution, based on the physical construction of a long-term infrastructural element aimed at stabilising human relations with the environment. The kampung, in turn, privileges the dynamism of responsive social practices. Kampungs show the existing vitality of adat and gotong royong values that link Indonesian cosmologies to social codes, producing strategies for an adaptive cohabitation between humans and environments. These social practices require coordination, negotiation, and flexibility.

Cosmotechnics is allowing us to approach urban solutions to anthropogenic climate change and, more specifically, to Jakarta Bay's controversy in a novel fashion. Cosmotechnics operate in a non-dualistic manner, by investigating the compatibility between global and local technics (in both directions) and by bringing to the foreground the techno-geographical logics that should lead any approach to climate. Cosmotechnics thus opens ways to interrogate the sea wall and the kampung, and to start conceiving new, diverse modes of structuring Jakarta's techno-geographic milieu. If it is necessary to build a sea wall, the design should explicitly address its role as an element framing Jakarta Bay's geography. The existing focus on the plan and on mythological imaginary should be replaced by a more careful calibration of the wall's section, allowing a dynamic interchange of water bodies and ecological conditions. The kampung shows the potential role that adat values and gotong royong practices could play in the construction of a sea wall. These notions question the value of infrastructural stability. Currently, the sea wall project aims to fix, permanently,

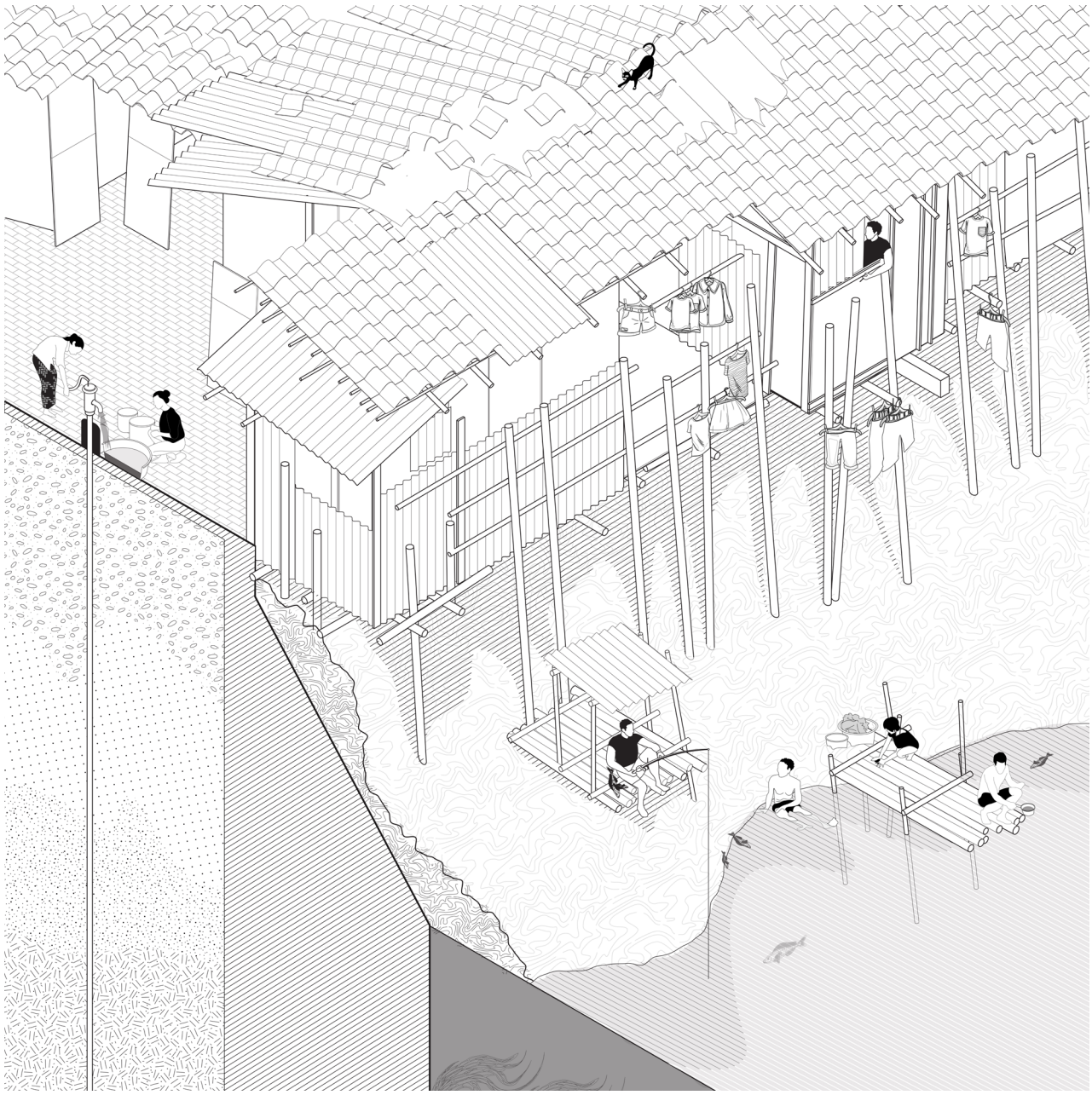

Fig 5: Kampung residents' stewardship of water. Image: Sasha McKinlay.

Jakarta's relation to the environment. Kampung strategies show that more flexible infrastructural operations are possible, supplemented by the influences of adaptive social practices.

These social practices can engage not only physical but also digital cosmotechnics. Coordination between kampung inhabitants already utilises diverse digital means. Jakarta's responses to climatic events can elevate this capacity for coordination. Hui has referred to the need to cosmotechnically rethink smart city technologies, which he considers part of a broader trend towards programmability as a planetary technology. The possible coupling of monitoring technologies with a more robust articulation of the kampung's digital practices reveals a possible path to a less technocratic, more cosmotechical approach to urban digitalisation.

Cosmotechnics opens a debate about Jakarta's attitudes towards anthropogenic climate change, both through the reinforcement of the kampung logics, and through the problematisation of the sea wall. Our complement to Hui's thought comes from the fact that, while he tends to separate cosmotechnics from political debate, the actual spaces for the practice of cosmotechnics are deeply entangled in political controversies. In that regard, our approach shows that a crucial value of cosmotechnics is its capacity to reformulate the technical procedures that are at the heart of the increasingly present political conflicts associated with responses to anthropogenic climate change.

One thing is clear. The history of Jakarta's infrastructural interventions exposes how problematic the unmediated, direct transposition of infrastructural techniques can be. The Dutch system of canals has always been an inappropriate solution for Indonesia's extreme and capricious conditions. A cosmotechnical approach to design requires avoiding the errors of hasty translation. By no means is this a negation of the value of interchanging cross-geographic knowledge, nor does it hold local technics to be unquestionably superior. On the contrary, cosmotechnics enables a dialogue between technical practices and helps us question existing global technologies. Finally, it offers a next step: to reintegrate them, in a considered manner, in our constant, planetary processes of technical interchange.

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Biography

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Shipwreck Architecture:
A Speculative Hauntography

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Abstract
'Shipwreck Architecture' draws a connection between cosmotechnics, surrealism and object-oriented ontology, using an architectural design framework as a departure point. The introduction connects the tragic aspects of Yuk Hui's cosmotechnics to the tragic pairings created by figurative surrealists René Magritte and Salvador Dalí, and to the object-oriented project of shipwreck hauntography. This trajectory of ideas is then projected onto a creative project: a speculative history of shipwreck architecture, where the cutting edge of biological research is extrapolated into a technological future when the distant aims of today's technology are ancient history; when the first generations of grown buildings are preserved as ruins; when giant decommissioned carbon-capture factories drift like ghost ships across lakes of their inky waste, when people remember shipwrecks, caused by the hazards of rising sea levels, later exposed by sinking sea levels and converted into hotels and theatres; and finally, when these theatrical memories provoke such nostalgia that shipwreck architecture would be replicated and fabricated.

Keywords
Speculative architecture, speculative history, ecological thinking, surrealism, object-oriented ontology

Tragedy

There is a contemporary tragedy that beguiles us. It is a braid with many strands. Yuk Hui begins *Art and Cosmotechnics* by positioning tragedy as an ethos of art.[1] Here, we offer further evidence in support of a tragic art ethos, one that builds creatively from Hui's cosmotechnics and from philosophies of tragedy, surrealism, and object-oriented ontology, while using an architectural design framework as a departure point.

When Hui speaks of tragedy, he means it in both Aristotelean senses of *catharsis* and *hamartia*. Catharsis is understood by most Aristotle scholars as that familiar aesthetic experience of emotional release facilitated by certain narratives; in particular, catharsis is the purgation of pity and fear experienced while witnessing tragic art.[2] Hui notes especially the cleansing aspect of catharsis, a dissipation of anticipation and expectation.[3]

The second Aristotelian concept Hui values as an ethos of art, and the more important for our case here, is the tragically fated flaw, *hamartia*: the red nose, the strong yet vulnerable heel, the smoky gasses from our many fires. For all but the most hearty and masochistic, the tragedy of our selves and our all-too-singular culture can only be approached with the sweet promise of redemptive

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cosmotechnical salvation. In the reactionary spirit of an abject rejection of even the most necessary pain, let us begin with a childish American story, and then bravely walk forward.

In 1939, an important year in the history of surrealism, a copywriter for Montgomery Ward named Robert L. May premiered a children's book featuring the fictional character Rudolph, the red-nosed reindeer. According to Western Christian cultural tradition, on Christmas Eve, Santa Claus flies on a gift-laden sled pulled by a dozen or so levitating reindeer. In May's book, one of these reindeer, Rudolph, became the group's tragic figure.[4] In 1948, May's brother-in-law and American songwriter Johnny Marks condensed the story into four memorable Christmas carol stanzas. The story, in all its forms, follows the same pattern. The reindeers who pull Santa's sleigh coalesce into a group against Rudolph, who they ridicule because of his strange physical characteristic, his glowing nose. When a change in the environment makes Rudolph's unique trait useful to the group, and he acquiesces to the group's request, the trait that was at first ridiculous becomes venerable.

Though notably gentler than a Greek tragedy, all the tragic components are woven into May's story. Consider by comparison the tragedy of Achilles. Achilles was dipped into a sacred river by his mother, held only by his heel, granting him superhuman abilities. The swift Achilles was one day offered a choice: carry on living with your family, watch your grandchildren prosper, and be forgotten forever, or travel with Agamemnon and fight against the Trojans where you will die and your name will be remembered forever. Achilles chose the tragic life, using his skill to excel in battle before dying following an incapacitating wound to his heel.

Rudolph's story would be more tragic in the Greek sense if, on that foggy evening, Rudolph died from a wound to his bright and shiny nose, moments after saving his fellow reindeer, and heroically rescuing Santa from mortal danger. In the imagined Greek version, the character's arc ends with a transformative, redemptive death. In the contemporary Christian version, the only thing to die is the other reindeer's labelling of Rudolph as an outcast. Rudolph and everyone else lives on, transformed, more accepting of others' differences. One can easily understand the tragic story of Jesus of Nazareth as situated pivotally between these two examples: its morbidity and darkness are a product of having been written in a Greco-Roman cultural context, and yet it anticipates some contemporary Christian mores of transformation, redemption, blessings and enlightenment.

Popular renditions of Rudolph's song typically add vocal responses at the end of each line, hence beginning: 'Rudolph the Red-Nosed Reindeer had a very shiny nose (like a light bulb). And if you ever saw it you would even say it glows (like a light bulb)'. And while the song varies, this repeated retort 'like a light bulb' recurs, giving it some prominence. Indeed, Rudolph himself may stand in as an animal analogy of the incandescent light bulb, an invention only a hundred years old when Rudolph was born, and available to the public to light their own homes for only sixty years. With each decade, the technology of the bulb's components was improved, making bulbs brighter and more useful, ending the era of burning whale oil, tallow and beeswax for light and warmth, unaware of the effects of making electricity at such scale.

With these popular examples in mind, Hui moves Aristotelian tragedy beyond a personal concern to a cosmotechnical one. Defining cosmotechnics as 'the unification of the cosmos and the moral through technical activities', he elsewhere explores nature and culture, and radically different epistemologies, such as science and mythology.[5] Over centuries of cultural (including technological and epistemological) homogenisation, the tragic flaw that we always find in an ancient Greek tragic figure now resides in a collective self-perception, which has one of many origins in the irrational core of rational science: 'science, or rationality in general, stands in tension with the world of myths and passions … Rationality wants to explain the sensible world according to *epistēmē*, while the world as such cannot be fully and objectively grasped'.[6]

Although Hui's cosmotechnics emphasises the local in the cosmological, centuries of colonialism and globalisation have challenged the perseverance of local expressions of mythos, techne and episteme. In the sensible world of a globalised, Anthropocene culture, some people see a tragic destiny, an atmospheric climate so weighty that to press against it seems like throwing sand at avalanches, blowing smoke at volcanos, or spitting on a tidal wave. But worse, these futile acts are celebrated as we throw sand with rigorously trained confidence, and hand out gold medals for sand-throwing. In Greek tragedy, there is less irony, and less ignorance of the futility. So we either observe these two extremes of sensing futility while feigning confidence, or we set the issue aside while feeling consciously or unconsciously guilty of culpably abandoning our own life-giving culture. In this context, Hui's claim that 'the tragic hero transcends the opposition between fate (necessity) and freedom (contingency)' renders freedom almost synonymous with irresponsibility.[7] But not all freedoms are taken with rebellion or lassitude; some freedoms are imposed through circumstance.

For Hui, the tragic artist has 'a status between the mortal and the immortal'.[8] Recall here that pair of aphorisms: Aristotle, in *Politics*, writes: 'Man is by nature a political animal, and he who is unable to live in society, or who has

no need because he is sufficient for himself, must be either a beast or a god', and Nietzsche responds: '"To live alone one must be a beast or a god", says Aristotle. Leaving out the third case: one must be both – a philosopher.'[9] Here Nietzsche's tragic philosopher – a species of tragic artist – is living on the edge of society.

Tragedy for Nietzsche begins to die when philosophers prioritise aligning beauty with rationality. The unreasonable fatalistic irrationality of tragedy is anathema to those who seek to find good order in everything. Since Nietzsche's death of tragedy, as Arthur C. Danto writes, 'the history of philosophy has alternated between the analytical effort to ephemeralize and hence defuse art, or to allow a degree of validity to art in treating it as doing what philosophy itself does, only uncouthly'.[10]

As Danto argues, Plato and Kant align in their attempts at disinterested perspectives towards art. For Plato, the philosopher-king is interested only in pure forms, and the Kantian aesthete is capable of looking upon works of art without any prejudicial interests of their own; 'the implication in both is that art is a kind of ontological vacation place from our defining concerns as human'.[11] Hence one arrives at the Kantian question of the purpose of art, or more explicitly, its pointlessness: 'The work of art looks as though it ought to be useful for something, but in philosophical truth it is not, and its logical purposelessness connects with the disinterests of its audience, since any use it might be put to would be a misuse, or a perversion'.[12] Centuries later, and in an act of aesthetic reclamation, surrealism began exploring purposelessness: objects whose purposes are thwarted by a peculiar quality, or objects whose purposes are generally unknown but a purpose appears likely. Other purposes are secret, some concealed by misdirection.

Surrealism's tragic-masochistic objects

The uselessness of art described by Kant and the tragic irrationality lauded by Nietzsche were both embraced by surrealism in the 1930s. For example, André Breton was captivated by the ability of art objects to elicit ambivalently both intense desire and an intense sensation of the tragic, especially fear.[13] Hailed as an icon of surrealism then as now, Meret Oppenheim wrapped a fully functional teacup in gazelle fur, rendering it both useless and beautifully, tragically irrational. Known in English as *Fur Teacup*, this bizarre sculpture was titled by Breton as *Le Déjeuner en fourrure* (*Luncheon in Fur*), a reference to Edouard Manet's *Le Déjeuner sur l'herbe* (*Luncheon on the Grass*) and Leopold von Sacher-Masoch's sadomasochistic novella *Venus im Pelz* (*Venus in Furs*).[14] Oppenheim's sculpture, and Breton's title, alludes to the desirous vaginal recession and the soft sensuality of pubic hair, but the fur-wrapped spoon resting on the saucer sparks horrid thoughts of cunnilingus with a hairy tongue or acts of bestiality. The object of desire is counterbalanced by the tragic object, the object of fear and revulsion. In Oppenheim's case, the desire-fear complex takes on a masochistic quality that foreshadows her other famous work, *My Nurse* (also made in 1936, consisting of a pair of upturned high heels tied to a silver platter and displayed as a roast turkey with a vaginal opening), and the overarching surrealist concept of the masochistic object.

Not surprisingly, there is an undercurrent of voyeurism in surrealism's masochistic objects, from Oppenheim's exposed and sexualised feminine objects to Salvador Dalí's objects. For Dalí, this concept of the masochistic object connects to artworks as commodities and the patron's masochism: in his words, the 'masochistic buyer … was avidly looking for the object capable of making him suffer in the most indefinite and least obvious way'.[15] This is an extraordinary observation: that art objects attain their power through the mysterious discomfort they provoke. However, as a class of objects, the provocative object is of a more general order than the art object, as many provocations are readily comprehended; that is, many kinds of provocation are rather obvious. Within surrealism though, the masochistic object is identified with qualities that are antonyms of the obvious: purposes are secret, nonexistent or unknown, even to Dalí's buyer. Not surprisingly then, surrealist researches that sought the 'least obvious' occasionally yielded real poetic discoveries, or, if you prefer, novel poetic constructions.

Surrealism's tragic pairs

René Magritte described his mid-1930s images to Breton as arising through a process of 'deliberate research'.[16] There is, Magritte explained, a 'certain feature residing obscurely within each object … something linked to it'.[17] Contemporary philosopher Graham Harman, in his object-oriented ontology (OOO), would refer to this 'certain feature residing obscurely' within every object as the object's unique quality. For Magritte, the unique quality, when objectified, produced the visual idea, or the visual metaphor. One example is the burning tuba in *The Discovery of Fire* (1935). Here, Magritte sought a companion object for flames, an object that could prompt metaphor.

Magritte understood metaphors as responding to our innate desire to upset the established order of things. When imagining an altered order in our metaphoric ideas, we momentarily reflect on the emotional valence of having those desires realised. In 1932, Magritte wrote,

> we are affected by the sight of an ordinary object placed in an unfamiliar setting; our secret desire is for a change in the order

> of things; and it is appeased by the vision of a new order (isolation)… the fate of an object in which we had no interest suddenly begins to disturb us.[18]

So what we, the voyeurs, see is that the burning tuba is not merely an object with unusual qualities, but an object with which Magritte intends for us to sympathise or even empathise – or perhaps to pity or fear. In either case, an object about which we care somehow more than habit ought to afford. In these attempts to prompt empathy with all living and non-living objects, Magritte's surrealism walks his audience away from the modern philosophical centrality of humanity with its anthropocentrism, and towards the anti-anthropocentric, and what we now call ecological thinking. Magritte recalls the highly surreal origins of his own object orientation:

> One night in 1936 I woke up in a room where there happened to be a bird sleeping in a cage. A splendid misapprehension made me see the cage with the bird gone and replaced by an egg. I had grasped a new and astonishing poetic secret, because the shock I experienced was caused precisely by the affinity between the two objects: the cage and the egg, whereas previously I had provoked the shock by bringing together totally unrelated objects. Preceding from this revelation, I tried to discover if objects other than the cage, thanks to the pinpointing of some elements peculiar to them, and a strictly predestined part of them, could not display the same obvious poetic quality that the egg and the cage had achieved through being brought together.[19]

Magritte's judicious distribution of affinity and unrelatedness can be understood as akin to OOO's relational and non-relational objects.[20] That is, one aspect of any given object has affinities and relationships with other objects (the relational, or the sensual, object), while the other aspect remains obscurely withdrawn (the non-relational, or real, object).[21] In the example of the egg and the cage, as in that of the fire and the tuba, one of the objects can be understood as an objectified quality of the other object. The burning tuba is apparent, yet the tuba is not melting, charring, or even smoking. The flames, the second object, are present as the objectified quality of the tuba, which is as unaffected as it is unaffecting; yet, the viewer may experience an unsettling concern for this burning tuba because the tragic pairing elicits sympathy. Similarly, being caged is a quality of the egg, so the cage exists as an objectified quality of the egg. As it prevents the egg from escaping, the cage disturbs our understanding of the egg's objecthood. The viewer is left disturbed by the image and concerned by what this irrational and tragic pairing implies about the egg: its fate, its potentials, its threats – and, in turn, what it implies about the viewer's own powerlessness.

Shipwreck theatre

Cosmotechnical tragedy and Magritte's process of pairing masochistic objects are brought together in Simon Weir's ambivalent and strange subject, 'shipwreck theatre'. How do these two words effect each other? Does the theatre host an audience witnessing ships wrecking? Or is the body of the theatre constructed from a shipwreck? Or both? Just as Magritte said his approach sought to elicit empathy for ordinary objects, so the pair of words invites audiences toward empathic responses for shipwrecked theatres and theatred shipwrecks. At the same time, as theatres are effectively sanctioned locales for voyeurs, the coupling of theatre with shipwreck brings to mind Hans Blumenberg's classic philosophical text, *Shipwreck with Spectator*, which begins with the case of a spectator watching a ship sink from the safety of shore.[22] What does it mean to witness wreckage in real time, and what are the responsibilities of spectatorship? The masochism of the voyeur who cannot – or does not – turn away at the sight of unspeakable tragedy does speak in countless metaphors, within the context of surrealism as much as within our own unfathomable Anthropocene conditions.

With all this in mind, 'shipwreck' and 'theatre' were chosen by Weir to prompt text-to-image AI.[23] The lack of visual precedents for the AI to draw upon, and the ambiguity of the notion, led to many very different outcomes, some serene and idyllic, others harrowing and nightmarish. Of the hundreds of images generated, a select number were retained, not surprisingly, those seemingly gesturing to an unfathomable future.

When paired with Hui's cosmotechnics, which 'refuses' the narrative of linear progress with its tragic destiny and redemption – 'this homogeneous technological future that is presented to us as the only option' – shipwreck theatres were read as alternatives to the hyperfocus on 'technological singularity and transhumanist (pipe) dreams' that crash diverse visions of futures that might co-exist.[24] Instead, we might envision a cosmotechnics-to-come that contains shipwreck theatres as one of various 'constellations of relations, e.g., the parental relations between females and vegetables, or the brotherhood between hunters and animals.'[25] But the pairing of shipwreck and theatre, like Magritte's tuba and fire, or egg and cage, creates explosions of relations and non-relations, of affinity and unrelatedness. The non-relations, the nonsensical, the indeterminacy of such multiplicitous outcomes lends itself well to dreaming cosmotechnical futures where collisions of nature and culture are no longer deniable, if they ever were.

While Magritte's ideal viewers (and Dalí's ideal buyers) experience the tragic pairing and the masochistic object by feeling for, with, and against the burning tuba and caged egg, object-oriented ontologists Graham Harman and Ian Bogost say that this kind of experience brushes at the limits of access to any object.[26] No object can ever truly feel for, with or against, or comprehend, or even consume another object, because each object has this certain non-relational aspect, a hidden-away or occluded part that does not interact with other things.

Like Magritte's fire and birdcage, in the object pairing of shipwreck and theatre, it is the wrecks that are cagey, shifting, and indefinite. Shipwrecks, especially those located under water, are metaphysically and physically secreted away, in a dark and mysterious realm inhospitable to human presence. Because of this occlusion, the creative method termed 'shipwreck hauntography' is limited in its wrecky representations to depictions of the shifty and phantasmal object's way of being.[27] Representing the way of being of shipwrecks then, is representing the unrepresentable, so hauntography can only ever be 'an artistic method that represents (visually or otherwise) the ontological absent-presence of shipwrecks: that is, as things that defy complete phenomenological access, while inspiring speculation into the uncanniness of being a thing of anthropogenic origin but which persists beyond *anthropos*'.[28] With this definition in mind, a hauntograph has three necessary elements: 1) it depicts an object's way of being, across time; 2) it acknowledges that the object is beyond complete human access; and 3) it is rooted in realism, despite its necessarily speculative nature.[29] Each of the images below contains these three criteria, with a particularly heightened sense of speculation into the occluded nature of things given that the future, even more than oceanic depths, is entirely withdrawn from human access, phenomenologically and epistemologically.

Well aligned with the ideas and images presented here, shipwreck hauntography is also a pairing of sorts: a tragic object that has ceased to function as designed, and another object becoming increasingly aware of the limits of subjecthood – which may be understood as tragic in its own right – in regard to other objects; indeed, the hauntographer might even be considered a hyposubject.[30] There is an architectural component to both objects, shipwrecks and hauntography, with the latter devoted to building the unbuilt and drafting the failed design, and the former consistently being remade by various engineering marine forces, in what has been called 'naufragic architecture'.[31] Although these 'marine engineers', from microbes to plankton and nekton, work hard to create colonies on shipwrecks and to convert their materials into habitable or edible forms, Killian Quigley remarks that sponges, hydras and molluscs attaching themselves to wreckage are regarded as akin to ornamentation, 'troped as that which superficially encrusts, decorates, or adorns underwater stuff'.[32] This trope of invertebrate ornamentation has also affected architecture on land, where the adoption in Renaissance Europe of Vitruvius's *De architectura* as the cornerstone of architectural and archaeological theory positioned adornment as morally suspect, implying 'irrationality, illogic, untruth, and even moral decadence.'[33] Given that indeterminacy is a key quality of surrealism's objects and of the hauntographic method, and that moral decadence is often associated with the theatre, an architectural pairing of shipwreck and theatre might lean into the trope of invertebrate adornment as risqué nonsense – or perhaps even more disturbing, that invertebrates and their ilk might become the true cornerstones of a new, cosmotechnic architectural theory.

On the tour guide scripts

So that these shipwreck theatres can be read as cosmotechnical tragedies, they are presented within a loosely described fictional scenario in the distant future, as an illustrated series of tour guide scripts, which the guides recite to tourists visiting their scheduled destinations. The images depict an otherworldly architecture, clearly Earth, but with new coastlines and radically different architecture-ecology relationships. The purpose of the tour guide script is to encourage readers to view the images, not as meaningless AI products, but as speculative architectures. By considering them as real, we can begin to imagine the architecture's cosmotechnical inhabitants, and thereby tremendous cosmotechnical temporal difference.

The relationship between word and image here is grounded in a fictional construct that is deliberately loose. Within the readers' flexible frame of expectation, the angle of approach is again surrealist. Consider first Magritte's fondness for titling images with charismatic, enigmatic and suggestive poetry. As he explicitly stated, 'the title is related to the painted figures in the same way that the painted figures are related to each other'.[34] In Dalí's work, the figures and their titles are also related, though differently from Magritte; for Dalí, this often meant wrapping the objects in layers of irrational associations and referring to other art objects, similar to the way Oppenheim did. How many layers of association? For Magritte, Dalí's reiterations of irrationality became 'superfluous'.[35] For instance, consider Magritte's little surrealist object titled *Confiture de cheval* (*Horse Jam*), an empty jar with a hand-painted paper label bearing the title and an outline drawing of a horse. Magritte's catalogue raisonné interprets this as 'presumably a joke about horse shit'.[36] The idea of an ostensibly empty container given a provocative title was borrowed

from a 1919 work of Marcel Duchamp that Magritte admired: an empty container titled *50cc of Paris Air*.[37] The association with horses may relate to the fact that Paris was full of horses in Duchamp's youth, as Brussels was in Magritte's, and likely smelt of horse manure. Horse-drawn omnibuses were phased out in Paris and Brussels across the early years of the 1910s, replaced first by steam-powered, then gasoline-powered, vehicles. Consequently, we may assume that the changed character of the city air was noted by many across these decades, and air could be considered an object worthy of preservation. Five years after Magritte's reply to Duchamp, Dalí layered the idea in irrational associations:

> I hollowed out entirely an end of a loaf of bread, and what do you think I put inside? I put a bronze Buddha, whose metallic surface I completely covered with dead fleas which I wedged against one another so tightly that the Buddha appeared to be made entirely of fleas… After putting the Buddha inside the bread I closed the opening with a little piece of wood, and I cemented the whole, including the bread, sealing it hermetically in such a way as to form a homogeneous whole which looked like a little urn, on which I wrote 'Horse Jam.'[38]

This process of layering objects with irrational narratives that prompt irrational interpretation was an ingredient of the surrealist ethos drawn from Duchamp's ready-mades: that objects can be made art by an artist's nomination.

The relationships between the text and images in the tour guide notes take the surreal form described above. In our example, the irrationality has two components: in Magritte's terms, mysteries *du jour* and mysteries *de facto*.[39] Many of the mysteries *du jour* are recognised as fictional allusions to fictional worlds that we added to create theatrical realism, while others are reframed as *de facto* or proto-rational: for example, the assumption in the tour guide notes that humanity will have changed energy sources many times – horses, wind, water, tallow, whale oil, coal-powered steam engines, petrol-powered combustion engines, electric engines, nuclear engines – and yet still saw more efficient processes of energy materialisation in plants, fungi, and animals. There is an additional mystery *de facto* that architects will found a new capacity to grow buildings, and this technology will be passed and surpassed through a sequence of biotechnical improvements. Early generations of this new architecture decayed (unusually) and became subjected to reparatory modifications. Time loops back as historians reminisce and muse upon the failings of architectural methods that, today, we ardently seek. And as such, by sharing imaginings of catastrophes befalling our cosmotechnical salvation, these images of shipwrecks may come into gentle contact with latent masochistic tendencies in their audience, especially in those who ruminate on the valuable yet Sisyphean task of attempting to stabilise our relationship with our environment, like seeking stillness and balance while aboard a broad ship in the open ocean.

Tour guide script: **Day 1, 09:00. Expressionist Sand Architecture** [Fig. 1]
We begin our tour at the great sand caves. Millennia ago, ancient architects lined up wooden ships, then stacked more on top. They were covered with naturally occurring biosand, which sealed them in place and left hollow voids inside the rock in the shape of the upturned boats. The weight of the sand bent the ships' timber, some into curious shapes. What's most remarkable here are the architectural details that reveal how these extraordinary structures were made. Like the technology we use today, the bacteria used in the biosand bonded the sand grains together. Unlike today's techniques, here the biosand merged into the timber. Over time, the wood disintegrated into a thin layer of a rare cellulose-lignin-sandstone composite, visible today in the vaulted ceilings.

Over thousands of years, the original structures were buried beneath the weight of the biosand. Then sea-level rise and extraction by fracking dramatically shifted local seismic activity, with uplifts intruding into the underlying Messinian limestone formation, lifting the buried ships up to the surface. Strong aeolian activity during the Youngest Dryas stadial piled up blowing sand onto the protruding stone forms. Sand and biosand bonded to create elaborately ornamented types of dunes. The fine details slowly eroded, leaving the irregular texture on many of the exterior walls.

Inside the vaults you can experience uncanny acoustic effects, and the cool shade, of this superb example of expressionist sand architecture.

At midday we meet again here to travel to the seaside, and tonight we visit the underwater shipwreck.

Tour guide script: **Day 1, 14:30. Shipwreck Architecture Archaeological Site** [Fig. 2]
We will embark on our first example of shipwreck architecture. This ancient boat sailed hundreds of thousands of years ago, when the landscape was very different. When sea levels rose, coastal cities and towns were submerged into the intertidal zones, and many buildings were revealed and concealed by tides each day. These were dangerous places, the sites of many shipwrecks. Areas like this and where we will travel tomorrow, became famous for their many coastal shipwrecks.

Across this dangerous period of history, many families fled onto large ships, like this one, living at sea for many

Fig. 1: *Expressionist Sand Architecture*. Image: Simon Weir.

Fig. 2: *Shipwreck Architecture Archaeological Site.* Image: Simon Weir.

years, until cities fell further into the water, the fires ended, and harbours once again became safe. When these communities returned to land, they permanently docked to the shore.

For many thousands of years, architects burned shells to make the lime for their cement and mortar. The original building was made by the pioneering architects who trained those molluscs to grow their buildings. Architects cultured microorganisms to grow calcite structures – flexible anchor arms, towers, habitations – to hold the old ship in place, and soon enough, the ships became permanent settlements. For centuries, these structures were wonders of the world. Residents added intricate lines of enzymes, like tattoos, onto the living surfaces, and grew delicate fibres used in luxurious cellulose fabrics, and giant edible molluscs were farmed on the hulls' undersides.

Over time, people came to think of these vessels as villages or apartment buildings rather than as boats. The molluscs underneath grew into a solid foundation, and the ships' hulls deteriorated, eventually becoming among the first examples of Molluscan Baroque architecture.

Later still, after these town-ships were abandoned, the remaining ship timber on the upper decks began to ossify – a process accelerated by an evolved version of the biome that substituted mineral collagen for cellulose – making these behemoths into organic bone-stone composites that are part boat, part skeleton, part architecture. Unlike other boats in the area, this hull came to rest on a calcite outcrop which, when combined with the shell foundation, provided ample calcium for redistribution by the biome, so the lower part of the hull that looks like timber is actually stone. The colour of the hull has remained uniform because the halite from seaspray in this part of the harbour prevents lichen from discolouring the surface.

In more recent years, the sea has acidified, wiping away much of the molluscan calcium carbonate underneath the boat, and making the original form easier to see. As the sea acidified, the salty rain eroded some of the upper surfaces. Unlike today's ossification processes, which result in uniform surfaces, earlier biomes were less consistent and produced harder and softer areas, so the decay has produced these strange patterns.

Unlike the many other ships that once lined this coast, only this one survived because its hull was geologically connected to the seabed through its foundation of calcite bedrock and calcium carbonate shells. The other ships, which were anchored to the foreshore only by their calcite sea arms, were washed out to sea during acidic storms. This boat, once surrounded by dozens of others, now stands alone in the harbour as a testament to dynamic architectural formation processes along this coast.

Today, all town-ships are protected heritage, some partially restored for tourists. Visitors enjoy the mountainous mineral collagen formations, and the surprising details. An example of early biological architecture, before architects could grow precisely, its exuberant and irregular style comes from working *with* the unpredictable nature of their microorganisms' biomes.

Tour guide script: **Day 1, 19:30. Shipwreck Architecture Diving Base** [Fig. 3]

The auroras will begin soon. In the meantime, notice the architecture's smooth, glossy surfaces. These glasslike surfaces are in fact petrified wood. Although it doesn't look much like wood now – and technically, it is stone rather than wood – trees once furnished important parts of ship hulls, like the outer planking, the decks, and the stem and stern castles.

Back when the metal ship components of this theatre were submerged, microbial communities gathered on those parts of the hull. In doing so, they unwittingly protected those features from abrasive seawater and the erosion of strong currents. However, in these waters, microbial communities do not commonly colonise ship timber, because they can't metabolise the arsenic and tar that were used to seal the timber and prevent decay.

So, over long periods of time, the wooden parts of these sunken ships were permineralised by ocean currents carrying quartz and other minerals in their streams. Those crystalline minerals filled the gaps in the cell structure of the wood until the wood was turned to stone. Once sea levels began rising and hurricanes dominated shorelines, driftwood from onshore was carried under water and eventually stacked up against the shipwrecks. That wood was also gradually permineralised, creating this 'connective tissue' between and around the vessels.

As sea-levels subsided, and the ships were exposed to the surface again, and wave action eroded the petrified wood, giving the theatre its distinctive texture and luminescence. As we enter the theatre and await the aurora, note that the tables where we will dine are constructed by a biomanaged type of sweet fungus, whose spores blew into the theatre in the '60s during the last typhoon season. Please do not begin eating the table until the final course of the meal is served, and try not to spill food on the tables, as the chef has prepared a special dressing for the sweet fungus table as dessert.

Tour guide script: **Day 1, 22:00. Underwater Experience of Sunken Shipwreck Architecture** [Fig. 4]

Once decommissioned, these twin trawlers were moored in the harbour and served as duplexes to house young

Fig. 3: *Shipwreck Architecture Diving Base*. Image: Simon Weir.

Fig. 4: *Sunken Shipwreck Architecture*. Image: Simon Weir.

couples just starting out on their own. In fact, the first home of stage darlings Twyla Naviggi and Nero Tweller was at the stern of this trawler right here. Sadly, the boats were eventually condemned due to unsafe levels of iron corrosion, which increased the risk of ferrous infection among residents. Shortly after the last residents were evacuated, both vessels succumbed to iron sickness, began taking on water, and sank forty-five metres beneath the surface, where they were moored.

Years later, investigators noticed that the ships were no longer corroding. The Atlantic Meridional Overturning Circulation system resumed its flow, changing the chemical composition of the seawater, causing different chemical reactions with the metal of the ships' hulls. With the increase in cold-temperature peri-halites, instead of corroding, the metal began concreting by forming these bubble-like structures that expand slowly and absorb other items into themselves. This process can happen rather quickly, so be careful not to touch the surface. Observers estimate that the two ships will join together within the century. As you can see, it's a truly mesmerising spectacle to watch this chemical process in action, and to witness the fusion of these two old trawlers into one.

The question, of course, is what will happen once they are fused? Will the concretion process carry on to engulf the entire harbour, or will it reach a certain limit and then stop? At this point, it's anybody's guess what the future holds for these leviathans.

Tour Guide Script: **Day 2, 09:00. Abandoned Biofactory** [Fig. 5]

Like most early-generation biofactories, this one can be seen reflected in its lake. But watch out: it's not water, it's carbon-black ink. Built as a ship moored in its own reservoir, this biofactory chained together a series of biological reactions developed from trees to produce coldness. It was effective for its time, and its only waste products were a chalky timber-like substance and the black oily ink you see in the lake here. During the centuries-long drought, this liquid was left to evaporate in the sun, where the evaporated water was collected in receptacles suspended above the reservoir and distributed to surrounding communities. Once dried over summer, the solid components of this waste product were harvested in great blue-black chunks for biofuel in the winter, which, thanks to this biofactory and others like it, grew a little cooler each year until returning to hibernation norms.

The massive chalky timber horns, or tusks, grew beneath the lakebed, a by-product of the cold manufacturing process. They breached the reservoir's surface about thirty years after plant's construction, and after that, the tusks were harvested for use as construction materials. Visitors to the plant when it was operational would have seen vast flat surfaces and a small black lake. When lighter and stronger timbers produced by newer biofactories made these products obsolete, and yes, outlawed in some places, the tusks were left to grow into these huge monuments of the Neo-Cretaceous style. Now derelict, this biofactory drifts on ink, like a ghost ship on a great lake. This factory is still alive and still growing. Estimates vary about when the biofactory will naturally contract: between one and two million years.

As you walk the shoreline to experience the biofactory from different angles, you may notice that the air still feels cooler when you inhale. The air is safe, but the oxygen content is a little higher than usual, so if you start to feel lightheaded, please inform one of our helpful and friendly team members.

Tour Guide Script: **Day 2, 13:00. Shipwreck Theatre Ruin** [Fig. 6]

This stretch of the coast is famous for its series of shipwreck theatres. The coast is dotted with jagged rocks lurking just beneath the waves, which posed navigational hazards to sailors who often ran their vessels aground in foul weather. Over time, the coast developed a reputation for being one of the most dangerous in this part of the country. Then, rumour has it, unscrupulous captains looking to collect on inflated insurance policies would sail too close to the spectacular rock formations rather recklessly. However, some oral histories suggest something even more sinister, that shipwreck mafias were at work here. Using holograms to conceal the rocks, thieves waiting onshore would deceive captains into running aground. After the ship was wrecked, they would dispatch its crew and plunder its cargo.

Whichever story is true, this coast is a graveyard littered with the wreckage of enormous vessels. As the seas retreated, the rocky outcrops where the ships were stranded became exposed. At first, they were used as party places for adventurous youngsters, but as the seas retreated further, they became thriving businesses: dinner theatres, yes, like where we dined last night. In more recent years, as the seas returned, most have been abandoned once more to the waves.

Here in our first example, the architecture has been deformed by centuries of wave pressure interacting with the biofilms and cartilaginous organisms attached to the hulls, who absorb the water's force to make their own energy. Many visitors find the building has an eerie presence in the darker hours, as the abandoned theatre's

Fig. 5: *Abandoned Biofactory*. Image: Simon Weir.

Fig. 6: *Shipwreck Theatre Ruin*. Image: Simon Weir.

tide-powered lighting continues to shine years after its last performers left the stage.

Tour guide script: **Day 2, 16:00. Shipwreck Theatre Holovid** [Fig. 7]

On the other side of the cove we have another shipwreck. This abandoned theatre was one of the most popular examples of its day, with many famous people in regular attendance, and one can easily see why. The view, as you can see, is spectacular; however, much of it is an illusion. In fact, the smaller wrecked boats closer to us on the shoreline are not real; they were added by the owners' architects to provide a more dramatic, more theatrical ambience for the performances premiered here and the important guests in the audience. The architects resurrected a long-lost method called hologrammetry to create the illusion of wrecked vessels on a stormy sea, visible both from the coast where we are now and from within the theatre. But if you were to approach the boats, you would be able to swim right through them, because they are only made of light.

You may be wondering how patrons arrived at this theatre, since it's not connected to land, and everyone knows that this stretch of coast was less affected by the dramatic sea-level fluctuations of the past. However, the island-like appearance of this shipwreck theatre is also an illusion. Stop and listen for a moment and watch the waves hit the rocks. That's right, they produce no sound. This dynamic holovid is tidal-powered, so it still operates long after the building was abandoned. The holovid tracks the real water levels around it, so that it matches the shape of the real water, but if you watch for a while, you'll see the water perform strangely; that's the holovid. Years ago, one of the main attractions of this theatre was that visitors could experience walking on water; you see, the gap of sea between the cliff and the wreck is also an illusion. Theatregoers could walk right off the cliff and onto the upper decks of the fourth balcony with no risk of falling into the sea.

Tour guide script: **Day 2, 19:00. The Original Shipwreck Theatre** [Fig. 8]

The final destination of our tour is another shipwreck, the only theatre along this once thriving coastline still open for business. Performances occur whenever low tide coincides with early evenings, which happens five or six times a month. Though doors don't open for another hour yet, for us tonight they have already turned on their spectacular stage lighting. The 'shining sun' lighting design is produced by a hidden tower and lines of rigging behind the stage, which mirror and amplify the glowing of bioluminescent marine organisms. The audience enter along a pathway through the sand and board the shipwreck to the right. The cast and crew perform on the ship on our left. Typically, performances deploy smoke and fog around the stage, so that cast and crew can walk to and from shore unseen by the audience; these effects lend a magical, ethereal quality to the stage performances.

Of the three theatres on this coast, this one is the newest. Unlike the others, it was not built from any actual wrecked ships; rather, it was designed this way to honour the spirit of the earlier vessels. Inspired by the ancient concept of *Kunstruine* or artificial ruin, this copy of the original shipwreck theatre designs does not have the same lavish detail of earlier generations, and of course, lacks the aura of authenticity. From the beginning, it has been criticised as a cheap tourist trap, but it remains popular with visitors to this day, and the owners report growing audiences. In fact, they're considering another replica shipwreck theatre further down the coast.

But now, after having seen so many spectacular examples of shipwreck theatres, and with the outgoing ebb tide opening the pathway for us to enter this one, you be the judge: is it a tasteful homage to a time-honoured tradition? Or a weird simulacrum symptomatic of franchise culture?

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Fig. 7: *Shipwreck Theatre Holovid*. Image: Simon Weir.

Fig. 8: *The Original Shipwreck Theatre*. Image: Simon Weir.

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Biography

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Dr Sara Rich is Associate Professor of Theory and History of Art and Design at the Rhode Island School of Design. An enrolled member of the Waccamaw Indian People, she is a maritime archaeologist, art historian, artist, and author of speculative fiction. Her recent scholarship includes essays in the *Journal of Aesthetics and Art Criticism*, *Heritage*, and *Contemporary Philosophy for Maritime Archaeology* (which she also co-edited). Her most recent books include *Mushroom* (in the Bloomsbury series, Object Lessons) and *Shipwreck Hauntography: Underwater Ruins and the Uncanny* (in the Amsterdam University Press series Maritime Humanities, 1400–1800).

Cosmotechnologies of Community and Collaboration in Vandana Singh's Speculative Architectures

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Abstract
Yuk Hui, referring both to climate change and its accompanying social upheavals, writes that 'to confront the crisis that is before us', humans will have to rethink the idea of technological universality and how it constructs our relationship to each other and to the natural world. For architects, this means considering how much architecture today is constrained by a singular technological paradigm, and how architects can think the many technologies of architecture differently.

This essay considers architectural cosmotechnology through discourses in global speculative fiction (SF), fictions proceeding from different ways of understanding and being in the world, to explore the future implications of these fictions for architecture and other technological practices in contrast to the hegemony of global modernism – what I have called cosmotechnologies of community and collaboration. The short fiction of SF author Vandana Singh supplies an image of architecture that proceeds from different images of and concerns about the future, and is an exemplary practice in cosmotechnology. She reframes existing technologies and invents new technologies in a mode of practice that centres the experience of diverse cultures in technologies of community and collaboration where architecture becomes central to new ways of being in the world.

Keywords
Architectural technology, global futurism, CoFuturisms, Vandana Singh, science fiction, architectural sustainability, technodiversity

> Let me give you a preliminary definition of cosmotechnics: it is the unification of the cosmos and the moral through technical activities, whether craft-making or art-making. There hasn't been one or two technics, but many cosmotechnics. What kind of morality, which and whose cosmos, and how to unite them vary from one culture to another according to different dynamics. I am convinced that in order to confront the crisis that is before us – namely, the Anthropocene, or the intrusion of Gaia (Latour and Stengers), or the 'entropocene' (Stiegler), all presented as the inevitable future of humanity – it is necessary to reopen the question of technology, in order to envisage the bifurcation of technological futures by conceiving different cosmotechnics.[1]

By way of a quote from Yuk Hui in which he succinctly summarises his 'cosmotechnics', I start this essay by looking for the concept's affordances for a thinker in architecture. First, the concept helps us understand the emergence of architecture-as-technology in relation to the cosmology with which it is co-constituted. Second, it

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shows how architectural technology is not the result of linear progress, a teleological fantasy, and thus might be radically different from how it is presently imagined. Third, following Hui, we can understand that using technological systems enmeshed in the existing hegemony of global neo-liberal capitalism can do little to confront the present ecological crisis – a challenge to the entire practice of contemporary architecture including its conceptions of sustainability.

While the concept of cosmotechnics supplies the architectural reader with considerable ammunition to critique how the discipline values itself as a technological practice, the final portion of Hui's quote is something that is simultaneously an observation and an impassioned imperative: 'in order to confront the crisis that is before us... it is necessary to reopen the question of technology... by conceiving different cosmotechnics'. In this essay, I probe this question, arguing that this project of 'conceiving different cosmotechnics' is already ongoing, with consequences for architecture, within the global speculative storytelling traditions collected under the moniker of CoFuturisms, a project of imagining futures that bears superficial similarities to science fiction, but with important differences. The imagined futures emerging from cosmologies informed by diverse cultures, geographies and life experiences are a potent site from which to imagine the collaboration of moral and technical domains in these futures, with radical consequences for more just and ecologically sensitive forms of architectural practice. Finally, in order to demonstrate how technology can be reframed within speculative fiction, I explore architectural technologies of community and collaboration in the work of SF author Vandana Singh.

Architecture-as-technology

This essay sets out from an understanding of architecture, not as an accumulation of technical devices – mechanical and structural systems for example – but taking a view where it is possible to speak of architecture as a technology in itself as much as an assemblage of other technologies. I follow Hui through Heidegger and Simondon in defining technology as an intervention by a being in its environment in order to change its relationship with that environment, but Hui goes on to argue that there cannot be a universal conception of technology; building upon Simondon, the expression of any technology in a culture is entwined with that culture, its politics and cosmology, and so, Hui writes it is not appropriate to speak of one technics but rather many cosmotechnics – many ideas about what technology is and what it should be used for.[2] In naming cosmotechnics, Hui asks what is accorded place of privilege – as technological – in the imagined progress of the Western narrative of modernity, and what other ideas about technology might be forgotten or erased in that process, along with the cosmologies with which they are co-constituted.

By understanding contemporary technology as an inevitable consequence of a linear narrative of scientific progress, architects might be tempted to understand technology as innocent of any social consequence, a license for political agnosticism, or worse, a substitute for social or political innovation. As I argue elsewhere, many 'technological' approaches in architecture, from Buckminster Fuller through to contemporary practices in digital architecture, make claims for the social benefit of technology alongside claims to rationalism and enlightenment progress.[3] I conclude that essay by writing: 'While digital practices are often predicated on their implied futurity, any futurity that does not situate its imagination of aesthetic and material novelty within an imagination of an improved human or environmental condition only promises a future very like the dystopia of the present'.[4]

What then of the profession's recent fascination with digital technology: BIM, parametric form making, fabrication, or AI? If we can define technology as all the ways humans intervene in their environment, then the enthusiasm for digital technology is only one path among many; we can no longer privilege the robot over the brick, nor reinforced concrete over bamboo. Nor can we abide a Eurocentric bias that sees a primitive hut in the architecture of non-Western cultures while celebrating the supposedly subtle genius of Western production. From this point of view, making architecture has always been technological: a process of invention which manipulates the material environment in order to make it safer, more comfortable, and more amenable to – largely human – life. Then, architecture-as-technology is a fluctuating assemblage of many human interventions in the material world. Some parts of that assemblage are specifically tuned to manipulate the physical environment: keeping out the rain or wind. Some architectural technologies mediate social conditions; walls, doors and windows are technologies of including and excluding. Some architectural technologies manipulate an inhabitant's psychological conditions in producing well-being, comfort or pleasure. Within such an expanded frame, there are as many potential conceptions of architecture-as-technology as there are cosmotechnics.

As Hui argues, the present ecological crisis requires conceptions of technology that arise from outside the dominant cosmological paradigm. While there are many responses to the climate crisis in the profession, we might ask how much these are actually tuned to reproducing an existing lifestyle and world-view. Within the present paradigm, much of architectural sustainability attempts

to minimise to energy use of the building, as it is built, through its operating life, and after its use is finished. To achieve this, architects and engineers turn to quantitative metrics: from a material's U-value to kilowatt hours(KwH) and global warming potential (GWP). While admirable, each of these measures of architecture sustainability is tuned to preserve rather than question the existing way of building; they make a small substitution within an already existing assemblage of architecture-as-technology, and don't question many of the assumptions shaping our cities, homes and workplaces. Thus, they reproduce the same social, political and infrastructural relations that created the present ecological emergency. Given the global dominance of Western architectural culture, rubrics of sustainability largely defined by Western academics or software companies are deployed across the world. While such metrics focus on minimising harm, none of them offer the possibility to reframe affirmative relations with other humans and more-than-human ecologies and to fundamentally alter a destructive relation to the natural world. Such a commitment to a fixed cosmological paradigm, Hui argues, actually precludes the possibility of searching out practices in technology that reframe human relations with each other and with the planet.

In contrast, by analogy to biodiversity, Hui is searching for 'technodiversity': technological paradigms that arise from and are adapted to unique environments, geographies, cultures and historical contexts; 'technodiversity', he writes, 'is fundamentally a question of locality'.[5] By cultivating the emergence of local practices, each presents its own interventions in the world adapted to its unique circumstances and like biodiversity, cultivating such technodiversity also produces resilience in relation to the crises of the present; when multiplied together these practices overwhelm the dominance of a universal technics and universal cosmology and multiply the possible ways of being in and intervening in the world.

By no small coincidence, in the time before the rapid spread of architectural modernism alongside Western culture in the twentieth century, many historical building practices could be understood as both more ecologically sensitive and culturally attuned. However, while we can learn from vernacular practices, it does not follow that a conception of architecture from local cosmologies demands a return to pre-modern ways of living. Hui is emphatic that locality does not mean a return to traditionalism.[6] The same cosmological paradigms that informed such historical practices continue to exist, and it is incumbent upon the architect to seek out the potential in these cosmological paradigms for the imagination of sustainable and equitable futures appropriate to different localities.

In a rudimentary sense, a framework such as Kenneth Frampton's critical regionalism also aims to supersede modernism in its sensitivity to place and understanding of local technics.[7] However, as Keith Eggener argues, critical regionalism rests on a binary opposition between centre and periphery that does not value both equally, but rather romanticises certain so-called peripheral practices for consumption by the extant disciplinary hierarchy. He continues that the architects identified as critical regionalists are firmly within the disciplinary bounds of authority – generally male and educated within the academy.[8] To return to Hui's terminology, such practices make an attempt to approach locality while keeping a universal, 'critical' cosmology in place. Thus, a cosmotechnological view of architecture is neither a renewal of a vernacular, nor an appropriation of regionalism by an elite; it is rather a comprehensive reappraisal of architecture itself and its place in relation to different cosmologies, perhaps to the extent of undoing architectural disciplinarity itself.

While there are normative forces in the discipline – constraints imposed by a history of Western imperialism and patriarchal sexism as much as by operating in a neoliberal economy – I do not accuse all architects of proceeding from the same cosmology. There are many inspirational practices already engaged in rethinking architecture's technicity and its cosmological underpinnings. As Arturo Escobar reminds us, in contrast to the perceived dominance of Western systems of thought, we already exist in a pluriverse made up of the coexistence of diverse local peoples in the self-determined design of their socio-natural communities.[9] These local practices not only exist in the present, they also produce their own futures. It is within these futures that we can multiply possibilities both for the architectural profession and for our world; many architectures are possible within this pluriverse.

CoFutures

Hui's call for a 'technology-environment complex[es]' – which finds its genesis in ' a cosmic reality which is proper to [its] milieu' – finds a close ally in the critical discourse concerning Indigenous knowledge traditions, sciences very unlike the science that emerged from European cosmology.[10] Grace Dillon, learning from Gregory Cajete, points out that that locality is integral to Indigenous science:

> Indigenous scientific literacies are those practices used by Indigenous native peoples to manipulate the natural environment in order to improve [their] existence ... And since Indigenous scientific literacies are shaped by the diverse natural environments of the Indigenous groups that use them, no single set of practices summarises the possibilities.[11]

Importantly, these are not static or vanished traditions, they are ways of knowing the world that continue to evolve.[12] For Dillon, this junction of cosmology and scientific literacy continues within Indigenous futurism – stories about the future from Indigenous peoples all over the world drawing on notions of time, progress, and futurity very different than those in Western SF: 'this overcoming of global technoscientism', she writes, 'occurs by going back, way back, to tradition through the telling of story/ceremony, and by going forward, way forward, by mining the imagination to construct an ameliorated technology informed by Indigenous tradition and practice'.[13]

Dillon's introductory essay to the fiction anthology *Walking the Clouds* elaborates further: despite a 'lack of resemblance to taxonomic Western systems of thought', Indigenous knowledge constitutes a science in itself, especially as it ties together 'sustainable forms of medicine, agriculture, architecture, and art' in a deeply rooted 'spiritual interconnectedness among humans, plants, and animals', with significant consequences for sustainable relationships to place.[14] As an example, Dillon discusses SF author Nalo Hopkinson's *Midnight Robber*, especially an aspect Dillon calls 'reciprocal altruism', a knowledge of interspecies relations and mutuality that stretches backwards and forwards into deep time. This kind of fluid intergenerational conception of time, of the past and the future always being with us, is a significant difference from the linear progress and privilege of newness that characterise Western science and technology.[15]

Dillon develops the concept of Indigenous futurisms with reference to Afrofuturism – a term coined in the 1990s for a form of cultural expression that the centres the African diaspora's experiences of and expectations for the future in direct contradistinction to the supposed universality of Fukuyama's end of history or McLuhan's global village.[16] Both Afrofuturism and Indigenous futurism are examples of a recent fluorescence of futurisms that, although defined more recently, describe sometimes centuries-old speculative storytelling traditions. They are joined by futurisms from other localities: from South and East Asia, Latin America, Africa and the Arab world, among many others of increasing geographical specificity.[17] They are also joined by other speculative practices claiming a space in the future, from people marginalised on the basis of, for example, gender, sexuality or ability.

Bodhisattva Chattopadhyay argues that these 'futures from the margins' should be jointly valued as 'CoFutures'. Playing on the 'co-' prefix, Chattopadhyay argues that these futures be understood as complex, co-eval, and compossible; they arise separately from different positions in all their unique complexities, but none precludes another from being possible either in fiction or in the realm of praxis – they require 'solidarity' in 'recognition of difference'.[18] In recognising that the 'science' of science fiction often refers to nineteenth-century discourses that, for all their claims to enlightenment rationalism, are explicitly racist and exclusionary,[19] these CoFutures arise from different geographical, linguistic, and cultural world-views, defining the aesthetics and politics of each one's own future in ways which supersede both Western science and Western imaginations of the future while reclaiming continuing practices of speculative futuring from their imperialist denomination as SF.[20]

While each of these futuring practices maintains a vibrant tradition of storytelling, they are not only fictional, but also find their expression in community politics, activism and advocacy, forming a 'complex of ideas' that is at once political as much as it is artistic.[21] For peoples all over the world, this blending of the political and aesthetic is an ongoing agency in the imaginative construction of cosmopolitical and paradigms for the future as well as an affirmation in the present. As the discourse around Indigenous futurism and CoFutures shows, Hui's call for different cosmotechnics in order to confront the challenge of climate change is already answered by practices all over the world. Escobar's 'pluriverse' is already at work imagining its own futures, futures that reshape contemporary ideas about science, ecology, and technology, including ideas about what architecture is and can be in the future.

There are already architectural commentators who explore the contributions of SF to thinking architectural futures, especially those not constrained by profession's historical baggage. In just two examples, David Fortin explores the architecture of Indigenous futurism, while Amy Butt, alongside a cogent defence of why architects should read SF, also engages with architecture in works of feminist SF.[22] The present essay joins this work in showing how CoFutures resist the homogenising tendencies within so-called mainstream SF, not only in examining which cosmology takes precedence in a given future imagination, but also in the consequences for the concepts of science or technology as such. Using two short stories by Vandana Singh, I explore how architecture is considered as an assemblage of technologies especially when confronted with other social, economic and environmental strictures.

Vandana Singh's speculative technologies

Vandana Singh writes SF alongside her daily work as an associate professor of physics at Framingham State University. She is someone who exemplifies the challenge of naming regional futurisms, and the necessity of a descriptive framework like CoFutures. Born in India,

often engaging with themes from Indian history and mythology, and locations in the country, she is part of a centuries-long speculative storytelling tradition that continues in India, and indeed, she has published in venues that identify as South Asian or Indian SF. However, more than other regions, the rich linguistic and geographic variety of the subcontinent, not to mention its global diaspora, makes delimiting Indian SF very difficult.[23] In addition, Singh finds common cause with many other futuring traditions, including Indigenous voices both within India and across the world. Therefore, in Singh, we see a conception of locality not strictly constrained by geographic boundaries, but also, in perhaps a challenge to Hui, gesturing to the planetary as well as the local

Singh's literary output is largely in the form of short stories and novellas, gaining her considerable critical attention. In this essay, I will focus on two stories: 'Indra's Web', first published in 2011 in an anthology,[24] and later more widely in *Ambiguity Machines and Other Stories*, and 'Reunion', a novella first published in 2019.[25] In these stories, existing architectural technologies are reframed as technologies of community, while Singh's own practice offers insights into working beyond one's own experience in her technologies of collaboration.

Both of these stories revolve around an experimental settlement called Ashapur – Hindi for 'city of hope' – and one of the progenitors of this settlement, a scientist named Mahua. 'Indra's Web' is told through Mahua's inner monologue as she troubleshoots the settlement's energy infrastructure, while in 'Reunion', she awaits news of a long-lost friend while reminiscing about her role in the 'Great Turning', an imagined late twenty-first century shift away from a global capitalist economy. Both stories are told against the backdrop of climate change; 'Indra's Web' near an overheating Delhi, and 'Reunion' near a future Mumbai flooded by the rising ocean.

The stories share similarities with an ever-increasing number of fictions exploring the challenges of and adaptations to climate change. As many authors show, the global scale and import of climate change and the Anthropocene has long been available to representation and critique within SF.[26] In fact, climate fiction is especially present in SF from outside the Anglo-American sphere, from communities most affected by it; in his survey, Chattopadhyay draws examples ranging from the emergence of Solarpunk in Latin American to energy futures from the Arab world.[27] Singh's stories fit comfortably here in exploring the impact of climate change from the point of view of a specific community, in exploring local adaptations from local cosmologies, and in understanding such storytelling through the lens of 'postcolonial' SF.[28]

Singh's settlements are built from a mixture of ancient and modern techniques: structures are made of mud and straw and covered with lime plaster, while the roofs of the settlement are 'an uneven carpet of green and silver – rooftop gardens broken by the gleam of solar panels'.[29] The settlements are divided into smaller domiciles, 'dome-shaped to reduce the impact of storms' with 'thick walls of clay, straw, and recycled brick', 'vegetables cascading off the walls', and with the space between given over to gardens. Within the settlements, the need for food is met by urban gardening, while former agricultural land is returned to wilderness. Energy needs are met by 'sun towers', an imagined solar power plant similar to the existing heliostat technology. Singh's smaller settlements are networked, connected to transportation, information and ecological infrastructures to share both knowledge and resources.[30]

If we follow a logic of discrete classification, it would seem that what Singh is describing is not really science fictional at all. Each technology in the list is already possible; sun towers and urban gardening, mud bricks and the fifteen-minute city are familiar or even banal to an architectural audience. They are not new individually, but when joined together in a different cosmological paradigm, they become technological assemblies imagined from and for very different futures. Thus, Singh dissociates the conception of technology from Western modernity's myth of linear progress with its sole claim to technicity; 'humans have always been technological', she writes; 'a traditional Navajo Hogan, for example, is a technology, as are the hunting tools of the Inupiaq people of the Alaskan North shore'.[31] In these stories, local technologies are no less advanced, and are perhaps even better adapted to life after the 'Great Turning'. In a move that is much more difficult in the epistemic space of Western SF, Singh is able to wrest futurity apart from mere technical novelty.

Singh's story also contains a warning about how so-called sustainable technologies might end up doing more harm than good when uncritically transplanted into the context of the Indian subcontinent. She shows how technology can be a (neo-)colonialist agent as its imposition without an understanding of locality risks alienating people, perpetuating inequality, and endangering local ecosystems. Technologies that would be uncomplicated technical innovations in Western SF are the object of consternation in Singh's future: a Santhali women's cooperative stops a project that replaces forests with artificial trees to enhance photosynthesis, transport workers in Odisha and Andhra Pradesh organise the largest strike in history to protest a robotic train, and experimental crops under foreign corporate control are set alight by local farmers in Karnataka.[32]

What is science fictional in Singh's text is not the technology itself, but the future context that imagines human societies feeling the intensified effects of climate change and corporate oligarchy, giving rise to a radical break as human societies organise themselves in ways which 'move civilization away from self-destruction'.[33] In short, Singh asks what human settlements look like in the context of a new cosmological paradigm that is both newer and far older than the 'madness of the twenty-first century'.[34] Beyond the explicit critique of capitalist excesses, the space of Singh's short stories offers some clues about how the human and more-than-human members of this society learn to live together, and how a cosmology centring such mutual care comes to reassert itself. Earlier, I discussed technologies of energy, food and housing in Singh's story, when in fact, by naming technologies one way or another, we limit how to view such technologies. And so, I propose two new constellations, and I provisionally suggest naming them technologies of community and technologies of collaboration.

Technologies of community

The city of Mumbai, the financial centre of contemporary India, becomes an icon of collapse in 'Reunion', and Singh uses that icon of architectural modernism, the 'glass towers ris[ing] above drowned streets', to implicate both the architecture and economics of globalisation in this 'Age of Kuber'.[35] However, the drowned streets are not only an image of collapse; she also asks whether the technology of the city itself is appropriate for human settlement. As Tony Fry has argued, while humans have long lived in cities, many present-day cities may be understood as a colonial technology, as they encode colonial authority and remain riddled with the fear of the colonial apparatus.[36] The fixation with the city itself is hardcoded into European languages; the Latin *civitas* conflates the physical city with citizenship, civilisation, and civility. Singh asks us to question the city as a technology for community. 'Maybe', Mahua asserts, 'the city isn't the right idea for what we're trying to do', because as a technology, the city promotes acceleration, isolation, work and stress, moving 'beyond the scale of human social adaptation'.[37] By contrast, Singh proposes to nurture community in different modalities and scales of interaction, and even to extend the notion of community to those often excluded; she advocates not only more equitable social relations between humans, but also with other species.

In terms of physical community, Singh proposes a network of small settlements, she calls them 'bastis', adapted to the scale of human mobility and social relationships. The first settlement is a former city dump, and her protagonist invites slum dwellers and climate refugees from a flooded Bangladesh to become the first inhabitants of her settlement and to collaborate with her in that development. In Hindi, 'basti' can mean dwelling, but also carries a more pejorative sense of village or slum.[38] Singh uses the word to play upon the antagonism between the city and this new form of dwelling, as much as on the antagonism between global capitalism and the other cosmologies waiting in the wings.

The smallest scale of community she suggests is the individual domicile, of up to fifty people – she writes about 'families related by blood and by choice' – to explore the social technology of an extended notion of kinship in the settlements.[39] Each of these domiciles is clustered into a basti of a few hundred inhabitants. The spaces between the domiciles are devoted to food production, pleasure, and to the comfortable banalities of everyday life, 'allowing room for people to congregate in front of this chai-house or in that niche, so that old women could gossip and mind the little ones, and the wandering cows and pariah dogs had room to rest'.[40] The communities produced from this perspective give preference to marginal, everyday practices that would be largely unconsidered in modern conceptions of the city; the basti prioritises leisure and the – often unpaid – labour of childcare over economically productive land use.

Up to this point of my synopsis, Singh could be accused of a kind of romanticism for the rural village and the democratic decentralization of the Gram Sabha (village council). Singh does imagine that this particular technology of community continues, although it is a model that, for all its promise, is not without its problems.[41] But Singh also imagines connection at other scales; individual settlements are joined by multiple infrastructures. Some of these connections are physical: transportation infrastructure between settlements, a shared energy infrastructure, and ecological corridors to cultivate biodiversity. Some of the connections are informational; as a technologist, Singh's protagonist is pivotal in developing an open data infrastructure to aid governance and community – 'embedded intelligence agents' communicating information about climate, ecology, biodiversity, and local resources are an aid both to cooperative governance and to being 'companionably present with the non-human and inanimate'.[42] 'Indra's Web' describes how this 'myconet' technology, based on the way fungal networks enable communication between trees, is also the basis for decentralised communication networks between people. In 'Reunion', the characters turn their attention to deciphering this language in order to 'speak' to the more-than-human world, especially to the remaining, threatened major forests of the world.[43] The digital infrastructure that Singh imagines bears similarities to imaginations of smart cities the world over, in

the ubiquitous sensing, cataloguing and transmission of data. However, it differs in the way that information is produced, shared and consumed, and for whose benefit; rather than information infrastructures that are determined by the imperatives of shareholder value, the open data infrastructures that Singh imagines are for the purpose of equitable governance by a well-informed and connected populace.

While some may see nothing new in Singh's basti, it does differ drastically in the relations of authority, ownership, connection, and belonging within the community, revealing how much physical infrastructures intersect with other technologies of community, from politics to digital infrastructures. Like mud bricks and urban farming, her technologies of community also learn from real life practices: 'I imagine a positive (in all senses) feedback loop between such a [SF] literature and the material possibilities on the ground', she writes, 'each inspiring and being inspired by the other'.[44] As examples, she highlights the political self-determination and sustainable forest management in Mendha Lekha village, the participatory ecological agriculture of the Dalit women of the Deccan Development Society, and the Dongria Kondh tribals in Odisha, who have long sought to live harmoniously with their environment, in spite of their ongoing battles against the mining company Vedanta.[45] Technologies of community is one way of describing the intersection of diverse scales and modalities of being together; some of these are explicitly architectural, and some show how these spatial and material infrastructures reflect or reproduce other technologies of community in the political relations they allow or disallow.

Technologies of collaboration

One other significant theme that emerges in Singh's work is the practice of the technologist, both of her characters and of herself as author working in technologies of collaboration. In the stories, the character Mahua works by building collaborations across gender, religion and caste. While also recruiting promising scientists to her project, Mahua's innovations are made possible by building collaborations and trust with marginalised people: those in precarious housing, climate refugees and tribal peoples. The latter are especially important as the reader joins the character's journey from 'progressive urbanite' to a rediscovery of her own tribal ancestry and the corresponding forms of knowledge found there, especially as it is the Santhal people's 'reverence for the web of life' that forms the cosmological framework to critique the excesses of global capitalism.[46]

Both as a professor of physics who engages with climate change and as an author of SF, Singh supplies an idea of the technologist which invites investigation, an image that asks the technologists to engage in cosmopolitics within and through a practice in cosmotechnology. As an author of SF, Singh is cautiously optimistic about technology, but uses her fiction to ask us to consider the context and power relationships around technology:

> when I imagine 'positive' technologies, I think about the context – from where, and for whose benefit does the technology arise? What is its impact on people and their interactions, and on the rest of nature? How does it affect natural cycles within which we live? To think about any technology being positive or negative without thinking about its context is to see only part of the picture.[47]

She continues:

> So, there are two things we can do. One: ... to imagine, seek and build a truly egalitarian societal structure. Two: to listen to marginalised people – not only to become aware of the horrors of their predicament, but also to learn how they live in dystopia. They have important insights. Their experience, intelligence and creativity need to be acknowledged.[48]

That is to say, Singh demonstrates how technology is inseparable from political power, and that no technologist – and no architect – can reasonably ignore this aspect of the practice. She offers two courses of action: first, to imagine new social structures, and second, to listen to marginalised people. If the first is captured in, for example, the Ashapur stories, the second is better exemplified in her own writing practice. As someone who thinks about the future of technology, Singh also listens to and learns from diverse peoples. She invites others to share her writing practice, for example in inviting members of the Dalit community or various Indigenous peoples as advisors and teachers to inform her fiction and teaching. It is in this sense that Hui's locality might be thought in a more post-geographical sense; particular cosmologies might emerge from particular places, but are also enriched in the new planetary alliances they cultivate between marginalised cosmologies.[49]

Importantly, Singh is diligent about citation in her practice. While we might be familiar with citation within the conventions of academic scholarship, in feminist writing citation becomes a tool to showcase different points of view, to acknowledge one's own situated perspective, but also to give credit to those you are learning from, even if such learning is outside the auspices of academic authority.[50] Working with voices and identities other than her own, Singh acknowledges, is to walk the narrow 'path between erasure and appropriation'. This

engaged practice of citation is integral to understanding what voices are heard, and thus are given authority, and reveals voices that might be overlooked. Therefore, at its best, Singh invites the reader to listen to other voices as her acts of citation become 'pathways for readers to discover other stories and other writers'.[51]

In one citation, Singh draws upon the knowledge of Indigenous scholar Kyle Whyte in illustrating how the practice of technology needs to listen to other perspectives. This is especially true when the rhetoric of sustainability proceeds upon the same epistemic fallacies that created climate change:

> Indigenous narratives of climate change are stories about changes in kinship relationships, where kin are all we are connected to, not just biological relations – thus trees, rocks, ants, birds… Such an epistemology of coordination, to use Whyte's term, cannot make the fatal error of simply substituting fossil fuel infrastructure with green energy, nor can it endorse the displacement of Indigenous people from their lands for a wind farm, or permit the mining of the ocean for minerals for electric vehicles'.[52]

Technologies of collaboration are thus necessary for a technological practice in the future, and Singh invites us to understand this social technology as the thing that makes all other technologies possible. Importantly, the scale of such collaboration is left open. On the one hand this means to understand one's own body as a part of such social technology; Singh's character Mahua must eventually leave her mediated interfaces behind in order to learn 'the language before language that the earth speaks'.[53] On the other hand, in what could be an amendment to Hui's discussion of locality, Singh would also have us understand that 'local' and 'planetary' are not mutually exclusive categories.[54] Hui's pursuit of technodiversity necessitates that we remain in constant conversation, with our own situatedness as much as with voices and communities much farther afield, but as Singh reminds us, with 'humility as a key principle'.[55]

Conclusion

As an author of speculative fiction, Vandana Singh's is one example of a practice in searching out cosmotechnologies, both from her own experience and from humble and respectful collaboration with others. In the Ashapur stories, Singh explores the technological paradigms of a future society that centres the well-being of both people and planet, and in doing so, she asks us to reframe our view of technology. In re-framing already existing architectural and infrastructural technologies, Singh shows how even these can be reconsidered in the context of radically different cosmologies; in seeing community – with non-humans as much as humans – and collaboration as technologies in themselves, even seemingly mundane technologies can be adapted to 'reverence for the web of life' on local and planetary scales.[56]

From the architect, Singh asks for a critical perspective that is aware of how much of existing architectural technology is bound up within the singular worldview of neoliberal capitalism. She also shows that equating technology with newness actually misses the potential revolutions of existing technologies. However, Singh's stories should not be taken as a coherent political programme, and are rather more useful as a thought experiment about what we might fear from or hope for the future. It is one speculation among many; like Singh's basti, it is one of a 'million mutinies' and 'experiments in alternative ways of living and being'.[57] The continued experiment of seeking out new cosmotechnics is one that all architects can pursue in understanding the discipline itself as its own speculative storytelling tradition, able to search out community and invite collaboration within our own practice, and thus continue in the project of reframing architectural technology. Architects are substantially helped in this endeavour if they continue to read and learn from the many storytellers who work, often from marginalised positions, and to understand architecture using their own technologies of speculation from the positions afforded by these CoFutures.

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Notes

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31. Baishya, 'Because We Are Not Apart', 13.
32. Singh, 'Reunion', 351–52.
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Biography

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Not-Not as Another Spatial Logic of Constitutive Negation: Revisiting Hiroshi Hara as an Early Cosmotechnical Turn in Japan

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Abstract
This review introduces Japanese architect Hiroshi Hara (b. 1936) and his creative criticism against unilateral globalisation in the 1970 and '80s as a unique legacy of pioneering cosmotechnics in Japan. The growing discourses of cosmotechnics initiated by Yuk Hui has offered opportunities to revisit legacies of alternative perspectives on architecture, urbanisation and technology and thereby redefine the role of architecture as a major world-making agency in the Anthropocene. Joining such efforts, I examine Hara's 1987 collection *Kūkan: Kinou Kara Yōsō E* (space: from function to modality). I focus on three essays from this volume to trace the trajectory of his three main concepts 'function', 'homogeneous space' and 'modality'. Following Hara's appropriation of the Heideggerian 'tool' as a pivot to articulate 'modality' and not-not [*arazu arazu*], from its Buddhist roots through Japanese medieval arts, I show the relevance of these ideas in contemporary cosmotechnical criticism, and the similarities between Hara and Hui on geometrical space and Eastern traditions of constitutive negation. I highlight Hara's non-essentialist approach, which avoids the East-West axis while decentralising globalisation from beyond his own horizon in Japan.

Keywords
Hiroshi Hara, space, cosmotechnics, technology, globalisation, Japanese architecture

Hiroshi Hara and a cosmotechnical turn in Japan, c. 1970

Japan has experienced a range of modernisation processes since its reformation in 1868, parallel to but nearly always after the West, with the constant lag offering a creative distance for reflecting on its twisted relation to globalisation. As a term consciously imported from and drawing on Western modernism, the 'modern' and its derivatives like 'modern architecture' were never free of quotation marks in Japan, having inspired ironical criticism of Japan's self-imposed assimilation to Western modernity in the form of global industrialisation from neither occidental nor oriental traditions.[1] If anything is quintessentially Japanese in its modernity, it is that Japan cannot claim any convincing cultural essentialism, let alone representing the East as the Other.

Although still obscure in the Anglophone world due to limited translation of his work, Hiroshi Hara (b. 1936) is one of the most influential architect-thinkers from this school of thought in Japan.[2] Having earned a PhD in architecture in 1964 at the University of Tokyo, Hara started teaching and practising as an architect while contributing to artistic experiments in the late 1960s. After the generation of architects who undertook the country's material

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reconstruction through high growth periods, including the Metabolists, Hara advanced more conceptual reflection on the agency of architecture in its pre-materialised phases from the 1967 publication of his first book, *Kenchiku ni Nani ga Dekiruka* (What can architecture do?).

Exemplary of a cosmotechnical turn in Japan, I briefly introduce here Hara's second book from 1987, *Kūkan: Kinou Kara Yōsō E* (Space: From function to modality), focusing on three essays in it, namely '*Kinshitsu Kūkan Ron*' (On homogenous space) from 1975, '*Kinou Kara Yōsō E*' (From function to modality) from 1986, and '*Arazu Arazu To Nihon No Kūkan-teki Dentō*' (Not-not and a spatial tradition of Japan) from the same year.[3] As the book's title indicates, the fundamental framework, space, is investigated in a transition from function to modality, where function is designated the principle of modern architecture, and modality that of future architecture. Between function and modality lies 'homogeneous space' as the status quo, which continues to this day. The book can be divided in two parts: the opening 1975 essay as a piece of empirical criticism, and the rest as speculative explorations culminating in the two 1986 essays. Tracing the trajectory from function via homogeneous space to modality, I contextualise Hara in cosmotechnical discourses initiated by Yuk Hui, through some similarities and differences between their respective reinvestigations of geometrical space and Eastern traditions of constitutive negation.

From function to homogeneous space

As the foundation of this book, 'On homogenous space' investigates the global expansion of generic cities and the material-semiotic consequences of this growth across architectural, urban, and cosmological scales through what he calls homogeneous space. Yuk Hui observes that 'the [western] history of cosmology from its mythical origins up to modem astronomy… is fundamentally a geometrical question'; similarly, Hara also identifies the metrics of space as the kernel of modernity, suspecting that 'our imagination itself is constrained' by the 'hegemonic "space"… already embodied in architecture', even when we look up at the sky.[4]

Starting from the immediate architectural example of ubiquitous high-rises, Hara explains the essence of homogeneous space in architecture as the abandonment of function. His terminology defines function as integrating 'human life and things holistically' and therefore assuming biunique 'relations' between objects and purposes teleologically.[5] Due to intrinsic contradictions in specifying complex human activities, however, function was gradually redirected to an opposite tendency to neutralise architecture, to which Walter Gropius's *International Architecture* (1925) ironically put the final touch by abstracting individuals and nations into the universal human. Unfettered from specific local and historical conditions, the placeless imagination proliferates in Miesian universal space, which Mies van der Rohe prototyped in 1919 and 1921 in Europe and materialised in the US three decades later. Hara characterises this building type technologically: a cubic lattice mainly of steel and reinforced concrete, with vertical transportation and air-conditioning systems, enabling flexible planning, efficient modularity, and an independent constant microclimate. Hara coins the term 'homogeneous space' as the 'form of space that such buildings envision as an ideal', which is 'not limited to buildings alone'.[6]

Accordingly, Hara applies the concept of homogeneity to urban space as 'another receptable that avoids the fixation of particular relations [functions] and abandons the identification of places' while stressing irreducible material complexity in the city.[7] Yet, with ubiquitous high-rises as the material-semiotic vehicles of homogeneous space, the city-wide abstraction is enacted among interchangeable fragments constructed under the same principle and mobilised through various networking technologies, including transportation, telecommunication, logistics, water and energy infrastructures. Despite the impossibility of its full materialisation, the mobility-driven spatial homogeneity becomes an ideological slippage between the perceptible and the conceivable, neutralising material heterogeneities into 'mere extension'.[8] With this ideal/material duality ever maintained, urban homogeneous space intensifies its oppressed contradictions. [Fig. 1]

Beyond tangible buildings and cities, homogeneous space also extends to cosmological imagination as a pure, thus non-contradictory ideality. Exploring its genesis in shifting cartographic representations, Hara contrasts medieval T-O maps and the cosmological worldviews they express with later Portolan charts that reduce places into 'objects to be measured'.[9] The latter lack cosmological contents, but implicate a particular cosmological space outside of their frame: 'the world is already placed within a spatial container'; that container assumes 'the role of coordinates' and is 'big enough to encompass the world'.[10] To contextualise technology with this turn from plural concentric worlds into the world within one uniform receptacle, Hara explains the 'long time span from the conception of Cartesian space to its projection to Mies's architecture' by stating that 'technology had been preparing for making Mies's sketch possible' behind centuries of stylistic explorations.[11] Coupled with modern construction technologies, homogeneous space finally descended from heaven to earth, interlocking the three scales through its common qualities: 'nullification of place and meaning, detachment from nature, idealisation, measurability,

Fig. 1: Conceptual drawing of the Umeda Sky Building by Hara Hiroshi. The cloud is a prime example of modality, as Hara explains: ‘clouds, fog, rainbows, mirages, and so on, are all analogies for architecture and the city’. Source: Hiroshi Hara, *YET*.

container-ness, objectification of phenomena, … manipulability, and, ultimately, its isotropic, homogeneous and continuous nature'.[12]

This historical entanglement between modern cosmology and technology into homogeneous space resists further changes, despite newer spatial conceptions and techno-scientific developments that would have challenged its Cartesian-Newtonian absolutism. Hara mentions Riemannian geometry, field theory and topology in the late nineteenth and early twentieth centuries as examples, as well as more recent distance-shrinking communication and transportation technologies. Thus, questioning what it is that has perpetuated homogeneous space, Hara turns to broader technics preceding modern technology, specifically the 'toolset' for spatial representation:

> Today we know new images of space … Nevertheless, our imagination is not liberated, insofar as it is surrounded by tools that are integrated with homogeneous space. For it is this integrity of space and its toolset that becomes the dominant surface of a culture and defines the inertia of things. We may need to begin with the task of replacing the toolset, namely, the method of representation, before directly exploring new space that would encompass our culture.[13]

Hui quotes Bernard Stiegler to discuss 'drawing in the sand' in Plato's Meno as a 'technical tool' that retained geometrically-intuited space and modern western cosmology subsequently; in a similar move, Hara regards Mies's sketch as a resolute support for far more massive homogeneous space.[14] Hara thus started out by exploring words and images as cosmotechnical tools to challenge the hegemonic representational framework. He later extended this work by translating homogeneous space into 'a glass case' and calling for 'a sketch that can replace this glass case*',* which is 'a glassy illusion like Newtonian absolute space' but 'built up materially in cities across the globe'.[15]

Continuing this departure from the status quo toward future possibilities, his essays in the following decade discuss homogeneous space rather briefly as the background against which its alternatives are proposed. For example, because homogeneous space is a receptable of fragments with no intrinsic organising principle, except totalised 'statistically or probabilistically', 'Bricolage about the logic of parts and the whole' in 1980 examines old settlements across the globe as 'reified logics' that spatially integrate buildings into a transindividual whole.[16] Because homogeneous space is 'a space without [heterogeneous] parts' as 'modernity tries to erase borders', 'On the Border' in 1981 rearticulates it with three overlapping symbolic borders: 'enclosure', a perforated insulator signifying its own inside/outside, 'floor', a field of activities that defines its own ambiguous boundary, and 'roof', an aggregator embracing heterogeneous enclosures and floors into a hybrid whole.[17] Because homogeneous space is dominant but just one of possible spatial cosmologies, 'On Spatial Schemata' in 1985 declares that 'space is to be designed' in this cosmological scope and propounds a pluriversal framework called 'the space of spaces' as a real entity that retains once-exteriorised spatial conceptions in amorphous, overlapping potentialities.[18]

What comes after homogeneous space: 'modality' through 'not-not'

At the convergence of all these explorations, 'From function to modality' in 1986 redefines Hara's function concept in a Heideggerian context and proposes modality to replace homogeneous space, while 'Not-not and a spatial tradition of Japan' in the same year develops *arazu-arazu* (literally not-not) as a logic to evoke the transition. In brief, modality is an attitude to grasp an object with its phenomenological 'potentialities,' and the logic of not-not helps the reframing by perpetually negating the finality of actualities.[19] To advance this argument, Hara first associates Heideggerian equipmentality with a functionalist ethos: 'Heidegger's "tool" was a conceptual device that represented the machine era. The machine is a concept that visualises mutual relations among things', while emphasising its dependency on industrialised imagination: 'although physics had already elucidated a world in which [mechanistic] causality is validated; it must be only after the emergence of various mechanical objects that people started recognising such necessary relations*'*.[20] Affirming the agency of things teleologically, this ironical effort to mechanise the equipmental structure of life into transparent causal systems failed to seize the complexity of human activities.

Homogeneous space thus scrapped Heideggerian tools, together with the impossible rationalist endeavour, by 'abandoning any setting of relations' as a simple solution to forget all the purposeful human activities and subordinate various kinds of things to the reproduction of a single flexible container.[21] In a coincidental association with the essence of technology Heidegger identifies in 'enframing', which 'precedes all' and 'demands that nature be orderable as standing-reserve', Hara stresses technology's pre-architectural dominance as already 'materialised hegemonically by socio-economic forces prior to [a new kind of] architecture that would have emerged through the dissociation of [functional] relations as its theoretical foundation'.[22] Reassessing the suspended possibility, Hara proposes modality to reaffirm material and locational contingencies beyond functionalist understanding of architecture

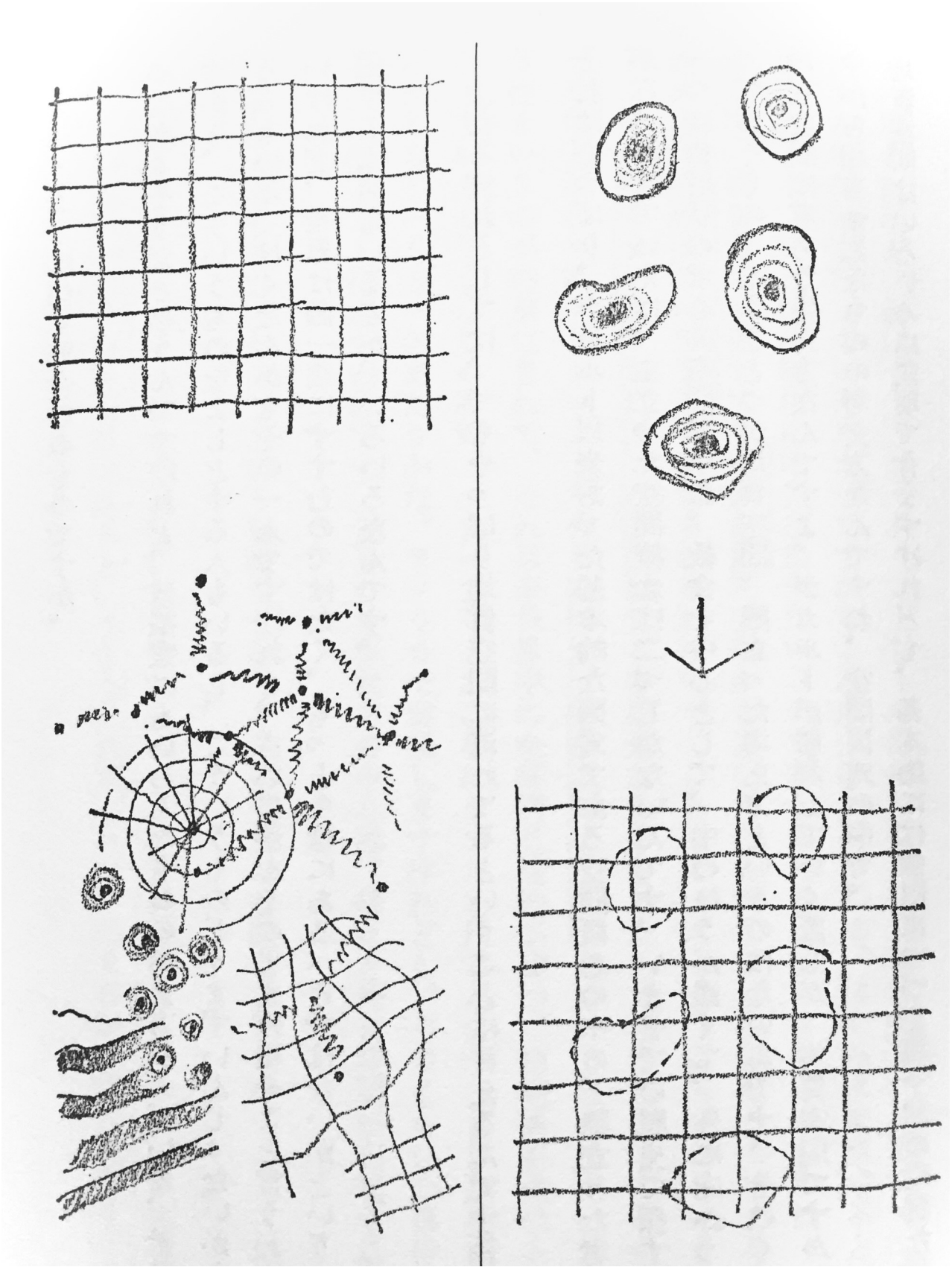

Fig. 2: Explanatory sketches by Hara Hiroshi. Left: Homogeneous space vs the space of heterogeneous systems. Right: Abstraction of plural concentric worlds into a geometric coordinate system. Hara's original caption reads: 'Modernity has erased borders and homogenised space'. Source: Hiroshi Hara and Senji Kuroi, *Conceptualizing Human and Space: Lecture on City/Dwelling.*

as a tool, stating that 'a tool also entails [diverse] appearances' and that 'a certain set of [functional] relations can effect diverse denotations' depending on how it is materialised and among what other things it is placed.[23]

Such contingent qualities are not fully transient, but 'bundled' and 'overlapped' successively into an amorphous whole, like a cloud.[24] In contrast to a functionally individuated tool, Hara compares this becoming of modality to a 'scene', where an infinitely complex environment meets the human as its negentropic interpreter to form 'an integrated system that generates meanings'.[25] Hara further associates the conceptual pair tool-scene with technology: tool with 'modern architecture: function - (physical) body - machine', and scene with 'contemporary architecture: modality - consciousness - electronic equipment'.[26] However, the two sets are not mutually exclusive, since Hara designates 'scene' as encompassing 'tool'. Similar to Robert Venturi's 1994 manifesto, 'electronic equipment' here is a metaphorical guide to the semantic, just as 'machine' is a technical image of causality, and thus has little to do with the literal application of new technologies.[27] Hara sees electronic equipment as offering imageries and vocabularies to help us 'look into consciousness' and hold elusive processes as a scene of modality.[28] [Fig. 2]

Shifting from modality itself to its generative logic, Hara re-examines Japanese medieval arts as an example of a particular form of constitutive negation, which he labels 'not-not' in contrast to dialectics as '"two springs" of culture'.[29] Warning that the 'Japanese tradition to be discussed is not unique to Japan', Hara quotes a medieval poem depicting an autumn scene at dusk with maples and flowers fading into darkness, which induces the 'ineffable modality of space' through the dis/appearance of the landscape simultaneously becoming 'a double image, ambiguously overlapping, or neither of both'.[30] Such modal contingency also characterises tea room architecture with its interfacial borders inducing constant fluxes and the potential inversion of contrasted qualities, such as front-back and outer-inner, which maintains 'fictionality' against brutal actualism.[31] Thus assuming that 'everything[-actual]-contains-everything[-potential]', Hara introduces Japanese Buddhist poet Kamo no Chōmei's Hōjō-an as an architectural paragon of not-not. Documented in his essay *Hōjō-ki* (The ten foot square hut) (1212), the Buddhist poet lived as a recluse in the three by three metre shed after moving twice in his lifetime; the floor area of this living space was a thousandth of his first residence. Hara explains its spatial quality 'unfolding while contracting,' or 'expanding while shrinking' in a clearer not-not opposition, as the physical contraction inverts factual and fictional spaces and alludes to the universe in the very negation of physical extension toward it.[32]

Exploring its Buddhist roots, Hara identifies not-not in consecutive negation – like 'A is neither a1, nor a2, nor…' – by which a series of negated predicates endows the subject with an inexhaustible number of properties. This redundant rhetoric is minimised into a cascading all-sided negation by Indian Buddhist philosopher Nāgārjuna in *The Mūlamadhyamakakārikā* (Root verses on the middle way) (c. 2–3 CE): 'Everything is true; and is not true; and is true and not-true; and is neither not-true nor true'.[33] Later called a Tetralemma, this form itself unfolds a given subject into all its logically possible oppositions, among which overlapping associated qualities are harboured. The resulting semantic field of connotations holds the space of not-not as embracing 'the world of holistic mood' or of changing 'appearances', which tool-oriented 'functionalism cannot step into'.[34]

Like dialectics in western traditions, constitutive negation is not unfamiliar in Eastern traditions, as Hui makes clear when he challenges logocentric modernism by introducing 'the negation of logos' through the Japanese monk Dōgen's 'think of not-thinking' as a 'pure negation' that induces the third way 'between thinking (*shiryō*) and not-thinking (*fushiryō*)… which is non-thinking (*hishiryō*)'.[35] Similarly, Hara understands negation as simultaneously denoting 'not-true' and connoting 'other possibilities', while emphasising its 'concurrent' spatiality against more progressive modern dialectics: 'not-not…postulates the spatialisation of time in its simultaneous unfolding, thus horizontal and synchronic in comparison with dialectics'.[36] Here is a complementary coincidence with Hui's criticism that geometrisation as the 'spatialisation of time' in the West initiated 'the mechanisation of causal relations'.[37] It is also the path to what Hara criticises as 'function' and its disposal into homogeneous space. Not-not thus offers an alternative of a non-geometrical 'spatialisation of time' without mechanistic presumptions, and Hara articulates its unsettling nature against more totalising dialectics: 'with regard to its [resulting] whole, dialectics defines its contour while not-not abandons the attempt. While the former regards a place as a receptacle, the latter comprehends it as a field. Also, while the former excludes ambiguity, the latter generates it'.[38] Thus unravelling the contour of identity into interfaces with its alterities, the space of not-not, or 'a space becoming in the border of its concurrent being and not-being' inserts momentary scenes of modality onto the flawless ideal of homogeneous space, revealing how porous it is toward underlying heterogeneity.[39]

From the east-west axis to non-essentialist decentralisation

I have given an overview of the way Hara's magnum opus criticises function and homogeneous space, and

proposes modality through not-not as a path to change the globally hegemonic, modern spatial cosmology. Although I inevitably had to reduce the rich nuances of his metaphysics, realism, and ontology of space through the uniquely material-semiotic agency of architecture. Until Hara's theoretical work is fully translated, I want this review to assert the relevance of his work to ongoing cosmotechnical discourse, as well as to established criticism of hyper-flexible planetary urbanisation, including Henri Lefebvre's abstract space, David Harvey's time-space compression, and Rem Koolhaas' junkspace.[40]

In closing, it is worth noting that Hara carefully avoids the East-West dichotomy while pursuing pluralist decentralisation, perhaps reflecting Japan's twisted modernity. But, more fundamentally, he shows the general context of architecture entangled with the globalised production of homogeneous space more materially and technologically than other technical activities. Hara begins 'Not-Not and a spatial tradition of Japan' by extricating tradition form essentialism, saying that it belongs 'to internationalism rather than nationalism'.[41] He concludes the essay by admitting: 'I have glimpsed some spaces of not-not in Europe and other places', and citing Pseudo-Dionysius the Areopagite's *Mystical Theology* (c. 5–6 CE) as epitomising not-not in Western traditions.[42] Even beyond Hara's own horizon, the concurrent negation of not-not can be found in Hegelian modal contingency as the 'absolute restlessness of becoming' (*absolute Unruhe des Werdens*).[43] Trusting that 'any culture must have some logic to maintain ambiguity in its undercurrent', Hara's own exploration of modality is exteriorised in his architectural works and representations. Thus inscribed in what he calls 'the space of spaces', a public sphere of our spatial imaginations, the legacy is open toward many yet-unknown and never fully identified peoples, places and traditions equally under the homogenising forces of unilateral globalisation.

Nearly four decades ago, Hara announced with characteristic understatement: 'this book lacks direct discussion about technology', and continued: 'I would venture to say this book has substituted "scene" for "tool" [as a technical] interface to reality'. [44] This humble yet confident ambition must be easier to understand today amid the growing vocabularies of cosmotechnics.

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Notes

1. See Noboru Kawazoe, *Gendai Kenchiku Wo Tsukuru Mono* (What creates contemporary architecture) (Tokyo: Shokokusha, 1958) for a discussion of post-war Japanese architecture in ambivalent contradictions with western cultural, political and industrial influences; see also Gabriel Kogan and Masamichi Tamura, 'Architecture Against Tradition', *Ronko* (2022) for technological aspects of 'tradition' in the period.
2. All translations of Hara's titles and of quotations from his work are my own. There are published English translations of some of Hara's texts available in *GA Architect 13: Hiroshi Hara*, ed. Yukio Futagawa (Tokyo: ADA Edita, 1993): 'Yukotai Theory' (1968/1993), 'Reflection and Inversion' (1978), 'Learning from Villages: 100 Lessons' (1987), 'From Function to Modality' (revised excerpt) (1986/1993), and 'Field Work on Two Belts' (1991), all translated by David B. Stewart and Yanai Takashi. In addition, *YET* (Tokyo: TOTO Publishing, 2009) by Hara himself includes short essays and project descriptions translated in English by Thomas Daniel. Other English materials on Hara include *Hiroshi Hara: The 'Floating World' of his Architecture* (New York: Wiley-Academy, 2001) by Botond Bognar.
3. Hiroshi Hara, *Kūkan: Kinou Kara Yōsō E* (Space: from function to modality) (Tokyo: Iwanami Shoten, 1987). The book includes four earlier essays: '*Kinshitsu Kūkan Ron'* (On Homogeneous Space) (1975), '*Bubun to Zentai no Ronri ni Tsuiteno Bricolage'* (Bricolage about the logic of parts and the whole) (1980), '*Kyōkai Ron'* (On the border) (1981) and '*Kūkan Zushiki Ron'* (On spatial schemata) (1985); two new essays: '*Kinou Kara Yōsō E'* (From function to modality) (1986) and *Arazu Arazu to Nihon No Kūkan-teki Dentō'* (Not-Not and a spatial tradition of Japan) (1986); and an introduction and commentaries that interconnect all these essays as a coherent criticism of unilateral globalisation.
4. Yuk Hui, *The Question Concerning Technology in China: An Essay in Cosmotechnics* (Falmouth: Urbanomic, 2016), 208; Hara, *Space*, 25–26.
5. Ibid., 49.
6. Ibid., 31–32, 38.

7. Ibid., 59.
8. Ibid., 60.
9. Ibid., 65. Identified in the seventh century, the T-O map is a cartographic method that represents the entirety of a cosmological worldview as non-Euclidian symbolic relations, which characteristically consists of an O-shaped outline and a T-shaped dividing line within it. Portolan charts were developed since the thirteenth century to represent geographical characteristics of ports more realistically, which Hara sees as prototypical of the geometrical imagination to be fully systematised by the Mercator projection in the mid-sixteenth century.
10. Ibid., 65.
11. Ibid., 70.
12. Ibid., 70.
13. Ibid., 81–82.
14. Hui, *The Question Concerning Technology in China*, 40, 214.
15. Hara, *Space*, 22.
16. Ibid., 73, 103.
17. Ibid., 162; Hiroshi Hara and Senji Kuroi, *Hito, Kūkan Wo Kōsō Suru: Toshi Jūkyo Ron Kougi* (Conceptualising human and space: Lecture on city/dwelling) (Tokyo: Asahi Publishing, 1985), 52.
18. Hara, *Space*, 186, 205–6.
19. Hiroshi Hara, 'From Function to Modality' in *GA Architect 13: Hiroshi Hara*, ed. Yukio Futagawa (Tokyo: ADA Edita, 1993), 128–129.
20. Hara, *Space*, 211–12.
21. Ibid., 220.
22. Martin Heidegger, 'The Question Concerning Technology', in *Basic Writings*, ed. David Farrell Krell (San Francisco: Harper San Francisco, 1977), 303–4; Hara *Space*, 220.
23. Ibid., 222.
24. Ibid., 228.
25. Ibid., 182.
26. Ibid., 239.
27. Robert Venturi, *Iconography and Electronics upon a Generic Architecture* (Cambridge, MA: The MIT Press, 1998).
28. Hara, *Space*, 240.
29. Ibid., 266.
30. Ibid., 246, 248.
31. Ibid., 174.
32. Ibid., 273.
33. Ibid., 254.
34. Ibid., 249
35. Hui, *The Question Concerning Technology in China,* 273, 278.
36. Ibid., 14, 265–66.
37. Ibid., 209.
38. Hara, *Space*, 265–66.
39. Ibid., 274
40. Henri Lefebvre, *The Production of Space*, trans. Donald Nicholson- Smith (Oxford: Blackwell, 1991), 49–50; David Harvey, *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change* (Oxford: Blackwell, 1990), 147; Rem Koolhaas, 'Junkspace', *October* 100, Obsolescence (Spring, 2002): 175–90.
41. Hara, *Space*, 245.
42. Ibid., 274.
43. G. W. F Hegel, *Science of Logic: Book II*, trans. Tatehito Takechi (Tokyo: Iwanami Shoten, 1960), 236.
44. Hara, *Space*, 16.

Biography

Masamichi Tamura is doctoral student of Tsukamoto Yoshiharu laboratory at the architecture department of Tokyo Institute of Technology (Institute of Science Tokyo from October 2024). His research focuses on material-semiotic entanglements between architectural concepts and techno-social environments, including ‘space’ after the mid-nineteenth century, ‘tradition’ in mid-twentieth century Japan, and ‘urban ecology’ in contemporary Tokyo. He also participates in the Canadian Centre for Architecture’s CCA-Mellon Multidisciplinary Research Program ‘In the Hurricane, On the Land,’ conducting a field survey that follows multiple forms of water in the built environment of Tokyo. In a long-term search for alternative urban spatial practices in broader contexts than architecture proper, Tamura has also worked as an independent curator of contemporary art since 2010 and as a local community organiser while co-chairing the Ageing Wellbeing and Parks Committee of World Urban Parks since 2022.

Aboriginal cosmotechnics: Alison Page and Paul Memmott, *Design: Building on Country*

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Abstract
The unassuming title of the 2021 Australian book *Design: Building on Country* positions Aboriginal making as potentially cosmotechnical, since it restores the interdependence of what in the west would be categorised as nature, culture, technology. As the editor of the series to which the book belongs reminds us, 'in the Aboriginal worldview, everything starts and ends with Country. … Everything is part of a continuum, and endless flow of life and ideas emanating from Country' which 'includes the built environment and objects, which reflects both a conceptual and a physical process with ancestral and cultural dimensions'.

And yet colonisation of the continent all but eradicated Country as it had evolved over 65 000 years. So having carefully pieced together the objects, spirituality, camps, shelters, materials and kinship of what Aboriginal design was (and is, in isolated ways), the book posits something more synthetic – an 'offering', as its conclusion graciously puts it, in which 'this new Australian design will improve the wellbeing of people and create places that ultimately mean more to all of us. It will extend Country, not abrogate it, and it should be created with that in mind – because we are all connected to Country'.

Keywords
Aboriginal, cosmotechnics, Country, indigenous design, decoloniality

The indigenous is one of the wells to which the modern disciplines of architecture and design periodically return, currently in response to demands for decoloniality in the face of inequality and climate change. Except we cannot return; so the exercise is always synthetic, always new, and abstracted, lest it become an exercise in pastiche or appropriation. Lately, the possibility of the 'cosmotechnic' has suggested a mode of criticality in design – an indigenous modernity, we might say. As Margo Neale – senior Indigenous curator at the National Museum of Australia, and the series editor of Thames & Hudson Australia's new seven-book First Knowledges puts it, 'Throughout the series, we acknowledge expertise from both Aboriginal and Western disciplines. This form of co-authorship is in the spirit of reconciliation, working well together interculturally'.[1]

Design: Building on Country is part of the First Knowledges series, alongside titles on Indigenous songlines, farming, astronomy, plants, law and innovation. Its two authors switch responsibility for authorship chapter to chapter so that it is co-written, Neale explains, from paired perspectives: 'Alison [Page] writes from an Indigenous perspective on her areas of expertise: design

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and storytelling; while Paul [Memmott] writes from a Western perspective on his areas of expertise: anthropology and architecture'.[2] Page is a Walbanga and Wadi Wadi woman from the Tharawal and Yuin nations; an architect, mentored by Glenn Murcutt among others, and associate dean at the University of Technology in Sydney.[3] Memmott, a transdisciplinary researcher based at the University of Queensland, is of Scottish descent, and has worked since the 1990s on the reformation of institutional architecture in a culturally appropriate way for Aboriginal people.

Aboriginal design and its cosmology

Some principles of Aboriginal design – functionality, sustainability, storytelling – emerge through the book's study of Aboriginal tools and Aboriginal relationships to land and to others. Tools include the iconic boomerang, fish traps (notably the development of fibre and the use of spinifex, a type of grass whose unusual properties are now being developed with industry collaborators – 'from the Dreaming to the market!')[4] and woomera (a multifunctional spear-throwing device that could also carry plants and seeds and cut food – 'it was the original Swiss Army knife').[5] Indigenous land designs – found in earthworks, camps, kinship and songlines – host the lightest of architectures: trenches, pitfalls, hunting hides, ground ovens, wells, storage platforms and posts, ceremonial stone arrangements, circular mounds, stone quarries, ochre pits and middens, foliage walls. Prior to colonisation, Aboriginal people moved around and camped on their own defined land estates, or Country, on a seasonal basis, the better to exploit available foods and resources, serviced by lightweight versatile tool kits. The range of travel was restricted by territorial rules and by the need to maintain religious obligations.[6] The mobile hunter-gatherer lifestyle needed relatively impermanent architecture, but for those in localities with plentiful food resources, more permanent camps could be established, which were often seasonally occupied, and sometimes located for the support of childbirth.[7] Most language groups employed a small repertoire of shelter types,such as the roughly circular domed shelters built throughout the western desert by curving bushy limbs inwards.[8] Camps would be laid out in clusters of shelters, socio-spatial patterns involving some principle of common social identity or relationship.[9]

Aboriginal spatial design prioritised kinship, land and belief over monumental architecture of the sort demanded in Eurocentric architectural history.[10] This means, though, that there are lessons for contemporary practitioners addressing inequality and ecology:[11] 'There was … no social hierarchy or wealth accumulation in the make-up of Aboriginal Australia that might have led to elaborate residences … such as the chief's houses and men's houses to be found in New Guinea and elsewhere in Melanesia'.[12] Aboriginal design is moreover anti-imperialist in its relation to Country, since in pursuit of a perpetual sustainable relationship, the 'inviolable connections' of land, kinship and knowledge 'prevented the idea of conquering large tracts of country by any one group, for the conquerors would neither have the correct ritual knowledge nor be in the appropriate totemic relation to manifest in other foreign lands'.[13]

Any lesson for contemporary practitioners is a paradox, though, because the hyper-sustainability of Aboriginality is contra 'innovation'. In search of Aboriginal designers, Memmott wonders about a category of elders he refers to as 'creatives' or 'designers' insofar as they critically interrogated traditional knowledge and patched its gaps.[14] But this interrogation was only ever to strengthen the seven-hundred-century Aboriginal cosmology in which Aboriginal design occurs. That cosmology is constituted by the Dreaming, Country, and Songlines. Picking through the book gives a good sense of that cosmology, which is worth quoting at length for any reader unfamiliar with it:

> The Dreaming refers to the ancestral past, at least some 70 000 years ago and most probably much longer, when Aboriginal people and plants and animals were adapting and evolving in a continent of changing environmental conditions. The Country is said to have been 'soft' in the Dreaming – able to be shaped. Aboriginal history is concerned with this time and contains accounts of the doings of Ancestral Beings, some of whom seem to have been animal, some human, but in most cases a combination of both … The Ancestral Beings (sometimes called Dreaming Heroes) were said to 'jump up' from the ground or sea. Many of them travelled about the country, interacting with each other and with the environment, experiencing adventures, making places, leaving signs of their presence – even parts of their bodies – and eventually dying and/or going into the ground, sea or sky. … They had power to change the landscape and even to change themselves into aspects of the landscape, such as rocks and trees, which then became and remained storehouses of sacred energies, also called 'spirits' or 'life cells' or Dreaming 'essence', associated with the particular ancestor. … Generally speaking, every part of Country in Aboriginal Australia contains a set of travel paths crisscrossing the landscape, in which sacred places occur that were created by the ancestors. … When there is a long travel route containing many sites of a Dreaming Hero, there will be a lengthy sequence of songs to be sung: hence the term 'Songlines'.[15]

Where it occurred, 'complex architectural symbolism was a result of the preoccupation with cosmology (Dreaming

beliefs) and cosmogony (the origin of the universe and our place within it)'.[16]

Thus the book allows readers to encounter an Aboriginal cosmotechnics, to borrow philosopher Yuk Hui's term – a unification of the cosmic and moral orders through technical activities.[17] Perhaps Aboriginal design is meaningful *only* within Aboriginal culture. Page writes, for example, that 'some aspects of the traditional cultural landscape are more difficult to translate into urban design, namely the highly organised social and kinship structures of camps … The modern city has different gender associations that form more organically and are not prescribed by lore.'[18] Page's architect colleague Kevin O'Brien is most explicit when he says that 'a genuine Aboriginal architecture industry is one where the architect of the projects from beginning to end is an Aboriginal person'.[19] In an oblique reference to the 'nothing about us without us' demand of disability activism, Page quotes First Nations architect Douglas Cardinal: 'it is time that colonial nations acknowledged that it is no longer acceptable for design to be done without us or for us, but by us. This approach will ultimately determine the originality and authenticity of architecture.'[20] A problem with early designs paying homage to Indigenous architecture was that they were too literal, and aimed at tourists.[21] Indigenous design instead strives for the importance of cultural landscapes over property. 'I could never give you a blueprint for defining Aboriginal architecture', writes Page, 'because Aboriginal architecture is a verb, not a noun, and it is in the "doing" that you understand it.'[22]

Indeed, there is no necessary difference between an object and its maker or user, since in Aboriginal cosmology objects are animated by their makers, ancestry, use, ceremony; this is why the maker of an object might sing to it while they make it.[23] 'When you are told that your job is inseparable from your spirituality, it forces you to re-evaluate how you approach your decisions', Page notes. 'The human relationships to objects over their life-cycle and their interconnectedness with the environment is a critical lens through which to view Aboriginal spirituality: it is not a separate metaphysical philosophy but, rather, how these relational networks are bound together'.[24] The architecture of British colonists 'believed in the dominance of humans over nature', Page reminds us, whereas the density of relation in Indigenous cosmology implies a richer ecology; 'before 1500', as Walter Mignolo and Catherine Walsh explain in their deconstruction of the western model of nature included in *On Decoloniality* (2018), 'most known cultures and civilizations on the planet (perhaps with the exception of Greece) were built on the assumption of the coexistence or complementarity of the opposite'.[25]

Design: Building on Country hints at an emergent cosmology of cosmologies, in which study of one Indigenous cosmology prompts scholars to draw comparisons with other Indigenous cosmologies. 'The philosophy that objects are containers of energy is shaped with other international Indigenous cultures', writes Page, finding affinities with North American Indigenous thought.[26] She quotes a 2014 talk by Dr Leroy Little Bear about the culture of the Blackfoot people of the north-eastern United States: 'In Western physics we talk about things in terms of matter … Whereas in Blackfoot, everything is about waves and when we really examine those energy waves, they are all about what we would refer to and translate as spirit'.[27] While Walsh and Mignolo draw principally on Meso-American cosmology, they recognise comparisons with the cosmology of Ancient China, noting that 'In Taoist or Daoist philosophy, the diversity of living that Western epistemology reduced to *nature* does not exclude the spiritual and the social.'[28] Yuk Hui's cosmotechnical description of Dao butchery, in which 'one does not use the blade to cut through the bones and tendons, but rather to pass alongside them in order to enter into the gaps between them' brings to mind Page's description of the Aboriginal framing and cladding of buildings, where 'the tangible and the intangible were represented by exposing the bones of a structure, and how it was in the 'spaces in between' that the spirit lived'.[29]

In a late 1990s hospital redesign by Page and her colleagues, 'walls became skins and windows were the gills of the fish', and Aboriginal elders spoke about the eventual building as if it were a manifestation of their ancestral totem, Pardi the river cod.[30] It offered an opportunity to bring a holistic approach to health and well-being – stabilised-earth bricks, lightweight materials and breezeways allowed cross-ventilation in the treatment rooms; a campground allowed communities to stay for months on end to conduct 'sorry business'. The design process, too, was relational: 'You schedule in time for conversation in the building of trust between the architect and the community', while training and employment of Indigenous people in the design and construction process offered a path toward economic independence countering the free reign of developer capitalism.[31]

If the very term 'design' has evolved over the last half-millennium as a particular suite of techniques integral to the cosmology of modern Eurocentric 'development', the use of the word 'design' in an Aboriginal context implies a different suite of techniques appropriate to a Country cosmology. The very choice of the word 'design' in Page and Memmott's book title is really a convenience to draw readers into a way of being in the world unlike design as it is conventionally understood under western modernisation. Much as Mignolo and Walsh show that 'nature' and 'human' are words and meanings without

exact analogue in many non-western languages, a linguist suggested to Memmott and Page around four thousand Aboriginal words approximate to 'design', but 'the list certainly didn't contain the word "design": clearly it didn't translate, on a word-to-word basis, into any original Aboriginal language.'[32]

A new Australian design

And yet most readers of this book are likely hoping to find out about an Aboriginal cosmotechnics not because they are Aboriginal themselves, nor because they are anthropologists, but because they see in Country cosmology a framework to make environmental design more relevant to the challenges of climate justice. *Design: Building on Country* is open to these readers, the First Knowledge of the series to which the book belongs engaging the 'second knowledge' of colonial modernity. Perhaps it is possible to translate between Indigenous and modern Australia; or perhaps it is possible to transition Australia through a critical synthesis of Indigenous and modern design.

Design functions here as something negotiating Jean-François Lyotard's *différend*, 'a case of conflict, between (at least) two parties, that cannot be resolved for lack of a rule of judgement applicable to both of the arguments.'[33] To help with this, Wailwan/Kamilaroi architect Jefa Greenaway created the International Indigenous Design charter (IIDC), a set of best practice protocols for working with Indigenous knowledge in commercial design practice.[34] Memmott argues that

> contemporary designers need to gain understanding when working in Australia so as to maximise the well-being and preferred expressions of sociospatial relations of Indigenous people ... Working for a client such as Anyinginyi or Myuma is relatively easy as they have clever Aboriginal staff who can translate these principles for a professional designer who engages in culturally in-depth consultation. However, the challenge is far more difficult in large-scale metropolitan public architecture and urban planning, where there are multiple clients from many walks of life.[35]

And so the book is mindful of limits on the prospects for a new cosmopolitanism. Still, that cosmopolitanism hangs in the text as a possibility for the transition of design; as Hui puts it in an essay on cosmotechnics, perhaps we can 'situate the "multi-naturalism" proposed by the "ontological turn" in anthropology as a different cosmopolitics, one which, in contrast to Kant's pursuit of the universal, suggests a certain relativism as the condition of possibility for coexistence.'[36] Along these lines, Page and Memmott cite Douglas Cardinal on the significance of Canada's installation by Indigenous architects and designers at the 2018 Venice Biennale: 'I firmly believe that the Indigenous world view, which has always sought this balance between nature, and culture and technology, is the path that humanity must discover for our future. The teachings of the elders are not the teachings of the past. They are the teachings of the future'.[37]

Those teachings can take the form of critique. For instance, in a 2018 article 'On Country Learning' co-authored with Uncle Charles Moran and Uncle Greg Harrington, Norm Sheehan (director of the GNIBI College of Indigenous Australian Peoples, Southern Cross University) shared the thought-provoking questions he asks students:

> What kind of being is your design? How does it move?
> What colour is it?
> Where does your design live? Where does it belong?
> What does your design say?
> What does it eat and what others does it sustain?
> Where does your design fit with other designs? To whom and to what is it related?
> How does your design grow and reproduce?
> When your design dies what remains does it leave behind?
> How are you related to the being of your design?[38]

And then this sort of critique begins to prepare the ground for something more cosmopolitan, more synthetic. For example, Kevin O'Brien devised the installation and performance art piece about the city of Brisbane at the 2012 Venice Biennale, *Finding Country*, as 'a pluralist contest between the traditions of Aboriginal space (Country) and European space (property) in Australia'.[39] It took the grid pattern of Brisbane and emptied it by 50 per cent, revealing new conditions by leaving only significant nodes and connections in the contemporary cultural landscape. Similarly the 2023 Australian pavilion at the Venice Biennale, *Unsettling Queenstown*, offered 'a ghostly fragment of colonial architecture, immersive sounds and imagery, and representations of the country "demapped" of its colonial patterns'.[40]

Design: Building on Country turns away from the loss of Indigenous culture toward its cosmotechnic revival within a flailing modernity. The book's attention to placemaking revives William H. Whyte on the interaction of humans, trees, wind light, sun, shade and gathering as the basis for public space, fusing it with Indigenous camp design and ritual, all keyed in to environmental comfort in the prevailing climate.[41] Here, food is integral to placemaking:

> What if a place offered people the opportunity to at least forage for seasonally available produce on the side, even if it

> was a reduced experience? … In 2019, Indigenous design firm Yerrabingin created a farm on the roof of a multistory building in Redfern, Sydney … This prototype is scalable and replicable not just across Sydney rooftops but in towns and cities all over Australia.[42]

Place, then, is an event rather than something rooted in geographic, primal authenticity. The colonisation of the Australian continent all but eradicated Country; Aboriginal social order founded in a tool culture of stone and wood was disrupted, for instance, by the sudden access to metal tools in the 1940s.[43] That catastrophic disruption now opens to the cosmostechnical potential for reappropriating and redirecting modern technology. 'When we are at the drawing board, making decisions to improve our society, we need to look back to look forward', Page writes. 'In traditional society, technology progressed only if it met the balance of improving efficiency, maintaining culture and protecting Country.'[44] Decoloniality is of the here and now, since there appears no practical restitution of the worlds it hails; it is now unusual to see examples of classical Aboriginal architecture that do not incorporate western materials and components, except at Aboriginal cultural centres, where old shelters are displayed as forms of cultural tourism.[45]

The sort of design described towards the back of the book, then, is really synthetic, and may be none the worse for it, as it strives for a cosmopolitan Australia, a cosmotechnics for already-modernised ground. Page describes the design of Victoria Square (Tarntanyangga), for the 2002 Adelaide festival:

> When you stand in the very centre of Adelaide, in the middle of Victoria Square, you see the horizon in all four directions. For the festival opening, we planned a dawn ceremony at each of the squares. Audiences are invited to come to the square that corresponded with the direction of their homeland … It was an upscaling of the locational principle and the protocols that surround it.[46]

So having carefully pieced together the objects, spirituality, camps, shelters, materials and kinship of what, historically, Aboriginal design was (and is, in isolated ways), the book concludes with an 'offering' in which 'this New Australian Design will improve the wellbeing of people and create places that ultimately mean more to all of us. It will extend Country, not abrogate it, and it should be created with that in mind – because we are all connected to Country'.[47] Cosmotechnics cannot restore pre-colonial society, land and nature; in effect, the New Australian Design is a new design of *Australia*.

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Biography

Simon Sadler is professor and chair in the Department of Design at the University of California, Davis. His publications include *Archigram: Architecture without Architecture* (MIT Press, 2005); *Non-Plan: Essays on Freedom, Participation and Change in Modern Architecture and Urbanism* (Architectural Press, 2000, co-editor, Jonathan Hughes); and *The Situationist City* (MIT Press, 1998).

Building with Jelly, or, Concrete as the Concretion of the Abstract

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Abstract
In his recent book titled *Béton: arme de construction massive du capitalisme*, Marxist thinker Anselm Jappe presents a critique of reinforced concrete as an hegemonic building material. In this review, I examine Jappe's book in conjunction with the questions of cosmotechnics and technodiversity raised by Yuk Hui. As this issue of *Footprint* rightly points out, the fields of architecture and urbanism have not yet properly addressed their implication in the process of the decline of technodiversity and the spread of Western technological monoculture throughout capitalist modernity. I argue that the homogenisation of building practices and the unanimous popularity of reinforced concrete is a major aspect of this process which ought to be examined. Expanding Jappe's value-critical analysis of reinforced concrete with Moishe Postone's account of how the peculiar social 'self-mediating' character of abstract labour in capitalism explains the transformation of labour into pure means and of its tools and products into mere objects, I intend to complement the question of cosmotechnics with an explanation of the decline of technodiversity grounded in the abstract logic of capital.

Keywords
Value-form, cosmotechnics, concrete, Wertkritik

It is not an exaggeration to say that concrete was the material of the previous century and, if things continue running their current course, will define the current one as well. Modern industrial societies are veritable machines for pumping out gargantuan quantities of concrete. Although the total volume of anthropogenic mass already caught up with the total volume of earth's biomass in 2020, by the year 2040 the latter will be surpassed by the global heap of concrete alone.[1] In the third chapter of his book *Betón: Arme de construction massive du capitalisme* (*Concrete: capitalism's weapon of mass construction*), Anselm Jappe showers us with several other staggering statistics. Between 1950 and 2019, the world production of concrete was multiplied by twenty-twofold at a growth rate three times faster than that of steel. Since 2003, China has used more concrete every three years than the United States did during the whole twentieth century. Besides consuming 10 per cent of the water in the world, if the concrete industry was a country, it would be the third largest producer of CO_2 emissions.[2] This is by no means a secret anymore. Labelled by some 'the most destructive material on earth', the ecological consequences of concrete have been underscored by plenty of architects and designers

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who call for a return to more traditional (and 'energy-efficient') building practices.[3]

Despite constituting the unavoidable backdrop of Jappe's searing book-length critique of concrete, an exposition of the ecological consequences of this omnipresent material is not his core purpose. Rather, the main propelling force of the book is a condemnation of reinforced concrete as a major factor in the progressive disappearance of traditional materials and vernacular building practices throughout the world; a crucial dimension of the decline of technodiversity resulting from the globalisation of Western technological monoculture – using the concepts introduced by Yuk Hui in recent years – and one which the architectural profession has yet to reckon with. In his own work, Hui has examined this decline and the concomitant foreclosing of non-Western cosmotechnics, that is, the way in which the complex imbrication of technical thinking and practice with culturally specific cosmological settings has been replaced by a homogeneous way of deploying technology instrumentally on a mute and disenchanted nature. While Hui's project provides us with conceptual tools that are useful to critique this foreclosing of alternative ways of relating technically to the world beyond instrumental rationality, and to imagine how modern technologies could be redirected towards future divergent trajectories, he does not delve into the precise mechanisms through which this monoculture has been established in the first place. I believe that Marxist theory can aid us in this purpose. Although Jappe's book certainly does not present us with a fully-fledged Marxist theory of the decline of technodiversity in architecture (nor does it aspire to), it does offer some interesting remarks that can suggest a path forward.

Before looking more closely at this point (which only appears in a small fraction of the text) and how Jappe approaches it, it is worth saying a brief word about where he's coming from. Jappe is an important figure of German *Wertkritik* (value-critique), a strand of Marxist thought formed in the late '80s around the journals *Krisis* and later *Exit!*.[4] Despite their many differences, *Wertkritik* can be regarded as part of the same theoretical milieu as other strands of contemporary Marxism such as *Neue Marx Lektür* and so-called value-form theory, all of which have, in their own ways and with different aims, attempted to dislodge Marx's mature critique of political economy from orthodox readings that portrayed it as either an 'alternative' economic theory or as a teleological philosophy of history. In constrast, these new readings of Marx have focused on elaborating the problems and concepts of abstract labour, fetishism, and the form of value, all with the intention of developing a Marxist critical social theory that elucidates the abstract and impersonal domination that the logic of value exerts over society.[5]

Betón can be situated within a longer lineage of Marxist critiques of architecture and urbanism. Jappe himself regards his contribution as complementary to classic works in the field such as those of Henri Lefebvre and David Harvey, thinkers who have developed pathbreaking critiques of the production of space under capitalism and its ensuing urban dynamics of inequality. However, Jappe argues that such authors have omitted a closer look into materiality. Thus, in the preface, he states what he vews as the three main contributions of his short volume: 'it highlights the problem of *materials,* it resorts to the so-called vernacular architecture to judge modern constructions, and it reveals the isomorphism between concrete and the logic of exchange value.'[6]

The chapters are considerably heterogeneous, ranging from the factual and historical to the polemic and even belligerent. The first chapter presents a useful short history of concrete as a building material, from its origins in the Roman *caementum* with which the Parthenon was erected, to Joseph Aspdin's patenting of Portland cement (the most prevalent to this day) in 1824, and finally to Joseph-Louis Lambot's revolutionary use of steel reinforcements for a rather whimsical purpose: to build a concrete dingy displayed in the 1855 International Exhibition in Paris. This very French past sets the stage for the next chapter, where we encounter what could be described as a short political history of reinforced concrete in the twentieth century. Polymorphous in both its materiality and its political affiliations, concrete was employed in all kinds of building projects, whether they were socialist, vanguardist, fascist, Stalinist, or social democratic: 'From the Soviet five year plans to the New Deal in the United States, China's Great Leap Forward and the construction of housing in Europe after the Second World War… In all these cases reinforced concrete was always summoned.'[7] One merit of Jappe's account is his emphatic dispelling of the idea that concrete could be regarded as a 'democratic' – or even 'proletarian' – material. While concrete did not attain its hegemonic status until the post-war period, this notion was established early on through its initial affiliation with the progressive bourgeoisie of the French Second Empire that established a 'precocious link between concrete and the progressive bourgeoisie, between "concrete" and "housing for everyone". A link that we will encounter again throughout this story.'[8] Jappe is adamant in refuting this association, not only on the grounds that there is nothing inherently progressive about mass-produced housing (often of dubious quality and durability) enabled by the sheer economic efficiency of a low-cost material.

Fig.1: Hoover Dam, Colorado. Source: Tim Felce.

In a very interesting argument (which unfortunately is not developed further), Jappe points out the role that the establishment of reinforced concrete as a de facto building material has played in the division between manual and intellectual labour, that is, the division between the architect and engineer, on the one hand, and the unqualified labourer on the other.[9]

Jappe's scathing critique of modern architecture, one of the main advocates of concrete throughout the twentieth century, is arguably the core pugilistic intervention of the book – and, to my mind, perhaps one of its weakest. Jappe often wears his disdain for modern architecture on his sleeve: a disdain that he admits has been a constant since his teenage years and was further ignited by the 'inconceivable ugliness' of Le Corbusier's Chandigarh project in India, which prompted Jappe to write *Betón* after seeing a picture of its current 'ruinous' state.[10] Likewise, Jappe can hardly hide his contempt for the Swiss architect himself. He dedicates a considerable portion of Chapter 2 to the burying of the commonplace image of Le Corbusier – and his architectural vision – as 'progressive' or humanistic, showing instead his fascist (and quasi-eugenicist) inclinations, his allegiances to authoritarianism and technocracy, and the close link between the Modulor and Taylorist ergonometrism. Satisfying as these acts of idol-smashing might be, Jappe's scorn for his political foes can sometimes veer towards the derisive – for example, when he offhandedly dismisses Heidegger's philosophy as a 'farce'.[11] Often channelling his energy into tackling individuals rather than elucidating the mute compulsions and structural determinants of the capitalist system, such a style of critique precludes Jappe from elaborating a more robust historical and dialectical analysis of modern architecture.

Jappe's engagement with what I described above as the decline of technodiversity in building practices can be found in Chapter 4, titled 'Building without concrete and without architects'. There he discusses the role of concrete in 'the loss of traditional knowledges and in the decline of craftsmanship in construction'.[12] If reinforced concrete is the 'sworn enemy of local particularities and infinite variations', this is because it lends itself to the prefabrication of its elements and thus to standardisation. The hegemony of concrete from the post-war period onwards has produced a veritable transformation in the conception and construction of buildings. Besides its imposition of the new division of labour in construction glossed above, it has substituted traditional building materials and their associated knowledges. Thus, Jappe regards the 'international style' or 'modern movement' as a movement geared towards the 'elimination of architectural diversity and its global homogenisation.'[13] As such, it is part and parcel with a more general understanding of modernity as being distinguished 'by *monoculture* in all domains'.[14]

In continuity with the establishment of such an architectural monoculture, in the seventh and last chapter titled 'The Concrete of the Abstract', we can find a suggestive attempt to explain how this has come about as a result of the logic of capital's encroachment in building practices, and why concrete constitutes its privileged material. In the introduction, Jappe asks the crucial question that this short chapter (barely fourteen pages) attends to: 'Is it possible that concrete sustains links with capitalism that cannot be reduced to the increase of profit for some, but that even go so far as to make it the perfect materialisation of the logic of exchange value?'[15]

In this last chapter, Jappe gives us a swift – albeit instructive and helpful – rehearsal of the path that leads to Marx's concept of abstract labour and his famous assertion that 'individuals are now ruled by abstractions'.[16] From Hegel's materialisation of the Idea to Feuerbach's humanist critique of hypostatised ideas and Marx's critique of Hegel's philosophy of right: the running thread is the diagnosis of an inversion between the abstract and the concrete, that is, the concretising of abstraction. In the case of capitalist society, the abstraction in question is none other than value. Without going into much detail here, we can say that value emerges from the particular social form of labour under capitalism. In a society where social reproduction is mediated by an impersonal global market, individual labours only become part of the totality of social labour through the quantitative comparison of the exchange-value of their products, that is, through a social process that implies the practical abstraction of labour.[17] Jappe describes the inversion of the abstract (that is, value that emerges from abstract labour) and the concrete in the context of the value relation in the following way: 'although it derives from the concrete, the abstract becomes, through a kind of inversion, in the substantial reality, and the concrete only exists as the temporary and interchangeable incarnation of the abstract.'[18] In Seb Franklin's apt formulation, value becomes an 'empty form that takes hold of material relations.'[19]

This is precisely the point where Jappe claims that 'concrete [the material] *constitutes one of the concrete sides of the exchange abstraction produced by value that, in itself, is created by abstract labour.* … This abstraction is expressed in a particularly concrete and visible way in two materials: concrete and plastics.'[20] Jappe's striking claim is thus that due to their physical properties, these materials are particularly adequate to the perverse hylomorphism of value. Concrete and plastic, Jappe argues,

are ‘perfectly isomorphic’ with value. This isomorphism is predicated on their shared penchant for homogenisation. As Jappe writes, the logic of value is ‘a gigantic *reductio ad unum*, an ontological *Gleichschaltung*, a permanent uniformisation. For value, the world’s infinite forms are nothing more than the coating of a substance that is always the same. Marx described this phenomenon well with the term *Gallerte*, jelly.’[21]

Marx’s striking – and for many, contradictory or catachrestic – portrayal of value through the figure of *Gallerte* has been widely commented on.[22] For Jappe, *Gallerte* is Marx’s term for the fetishistic or ‘spectral objectivity’ of value; as a ‘phantasmagoric, imaginary jelly’ it refers to the way the abstract social substance that is value acquires a certain ‘pseudo-concreteness’ when it is incarnated in concrete commodities. [23] However – and apologies in advance for the clumsy cipher – it would seem that with concrete, this pseudo concreteness of value becomes fully concrete. Reinforced concrete is Marx’s jelly come true. ‘Concrete is the perfect materialisation of the logic of value. It is its hypostasis, its incarnation. It represents, par excellence, *the concrete side of exchange abstraction*. *Concrete* is the visible side of abstraction … The jelly of abstract labour is made from limestone and rubble.’[24]

Jappe’s notion of concrete as the concretion of the logic of value could be fruitfully complemented with a series of interesting remarks made by Moishe Postone in his trailblazing *Time, Labour, and Social Domination* (a central source of inspiration for *Wertkritik*). There, he explains how the socially synthetic process whereby labour is practically abstracted in capitalism leads to the transformation of labour into pure means and of its tools and products into mere objects – in other words, to the ‘“secularisation” of labour and its products’.[25] He describes how in ‘traditional societies’ labouring activities and their products are embedded in a matrix of social relations that determine them with seemingly intrinsic meanings – which range from the ‘overtly’ social to the sacred – and, in a curious inversion, also with a socially determining character, that is, with the power to determine an individual’s position within the cosmos. However, in capitalist society we encounter the opposite inversion: ‘social relations in traditional societies determine labours, implements, and objects that, inversely, appear to possess a socially determining character. In capitalism, labour and its products create a sphere of objective social relations: they are in fact socially determining but do not appear as such. Rather, they appear to be purely “material.”’[26] Labour becomes instrumental and its product a desacralised commodifiable thing, ready to become the (pseudo)concrete incarnation of the value form. ‘The world of commodities is one in which objects and actions are no longer imbued with sacred significance. It is a secular world of “thingly” objects bound together by, and revolving around, the glittering abstractum of money.’[27]

Despite its brevity, I hope this short incursion into a possible Marxist theory of the decline of technodiversity will have provided a glimpse of how, besides being a worthwhile contribution to the critique of modern architecture, *Betón*’s particular interweaving of value and the very materiality of architecture opens up avenues of thought that have yet to be probed more extensively.

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2. Anselm Jappe, *Hormigón: Arma de Construcción Masiva Del Capitalismo*, trans. Diego Luis Sanromán (Logroño: Pepitas de calabaza, 2021), 77–83. Published originally in French in 2020, at the time of writing this review the book has yet to appear in English. All citations refer to the Spanish edition, and all translations to English are my own.
3. Jonathan Watts, 'Concrete: The Most Destructive Material on Earth', *The Guardian*, 25 February 2019, https://www.theguardian.com/cities/2019/feb/25/concrete-the-most-destructive-material-on-earth; Will Hurst, 'Concrete: Do Architects Have Their Heads in the Sand?' *The Architects' Journal* (blog), 16 January 2019, https://www.architectsjournal.co.uk/news/concrete-do-architects-have-their-heads-in-the-sand. In contradistinction to such appeals to traditional building methods, there has also been a lot of discussion around 'green' concrete and so-called 'sponge cities'. Lei Wang et al., 'Overview of the Application of Ecological Concrete in Sponge City Construction', *Frontiers in Earth Science* 10 (2022): 10–17, https://doi.org/10.3389/feart.2022.1085419.
4. For a compilation of canonical *Wertkritik* texts, see Neil Larsen et al., eds., *Marxism and the Critique of Value* (Chicago: MCM Publishing, 2014). Jappe himself has written a useful survey of this current; see Anselm Jappe, 'Towards a History of the Critique of Value', *Capitalism Nature Socialism* 25, no. 2 (3 April 2014): 25–37.
5. The term *Neue Marx-Lektüre* comes from Hans-Georg Backhaus's influential collection of essays, where he used this term to emphasise what he saw as a departure from traditional interpretations of Marx. Generally speaking, the term is used to refer to the discussion that ensued in Germany among followers of Backhaus (himself a student of Adorno) and later writers such as Michael Heinrich. The origin of the term 'value-form theory' is harder to pin down. However, according to Samuel Chambers, one can regard *Neue Marx-Lektüre* and value-form theory as practically interchangeable terms due to the shared emphasis that authors labelled with these terms place on Marx's understanding of the form of value and their attempt to re-evaluate the methodological bases of the critique of political economy. Chambers also points out that, while closely related and in many ways overlapping, the project of *Wertkritik* is different insofar as it embarks on a broader critique of modern society and is thus more closely related to early forms of Frankfurt School critical theory. Samuel A. Chambers, *There's No Such Thing As 'The Economy': Essays on Capitalist Value* (Earth: Punctum Books, 2018), 108 n5.
6. Jappe, *Hormigón*, 8; original emphasis.
7. Ibid., 56.
8. Ibid., 28.
9. Adrian Forty provides us with a useful historical account of the impacts of concrete on labour practices, albeit without adopting a Marxist standpoint. See Adrian Forty, *Concrete and Culture: A Material History* (London: Reaktion Books, 2012), Chapter 8 'Concrete and Labour.'
10. Jappe, *Hormigón*, 46.
11. Ibid., 48.
12. Ibid., 102.
13. Ibid., 40.
14. Ibid., 111; original emphasis.
15. Ibid., 16.
16. Karl Marx, *Grundrisse: Foundations of the Critique of Political Economy*, trans. Martin Nicolaus (London: Penguin Books, 1973), 164.
17. For the useful rendering of abstract labour as 'practically abstract labour', see Patrick Murray, 'Marx's "Truly Social" Labour Theory of Value: Part I, Abstract Labour in Marxian Value Theory', in Murray's *The Mismeasure of Wealth: Essays on Marx and Social Form* (Leiden: Brill, 2016), 120–55.
18. Jappe, *Hormigón*, 163.
19. Seb Franklin, *The Digitally Disposed: Racial Capitalism and the Informatics of Value* (Minneapolis: University of Minnesota Press, 2021), 197.
20. Ibid., 157. Emphasis in original.
21. Ibid., 165–66.
22. See in particular Keston Sutherland, 'Marx in Jargon', *World Picture* 1 (2008): 1–25; Sianne Ngai, 'Visceral Abstractions', *GLQ: A Journal of Lesbian and Gay Studies* 21, no. 1 (2015): 33–63.
23. Ibid., 164, 159.
    Perhaps it is worth quoting this intriguing passage in full here:

    > Now then, what is more similar to jelly than concrete? This is not a simple analogy. Concrete is the perfect materialisation of the logic of value. It is its hypostasis, its incarnation. It represents, par excellence, *the concrete side of exchange abstraction*. *Concrete* is the visible side of abstraction. It is a material without limits (liquid to start with), amorphous, polymorphous, and can be poured into any mould. It overwrites all differences and it is more or less always the same … It has *no form of its own*, but can adopt any. It does not exist in natural state anywhere, but it has become omnipresent. The same thing happens with value: it can change form, it can be money, become commodity, be money again, pass through a series of metamorphoses until it becomes unrecognisable – when it is incarnated in a use-value – to recover its initial form once again. Capitalist value has abolished all local particularities, all traditions, and imposes itself in every corner of the planet as the only law … in the same way, concrete has extended its monotonic kingdom over the entire

world, homogenising every place with its presence. The jelly of abstract labour is made from limestone and rubble.

Ibid., 166; original emphasis.

24. Moishe Postone, *Time, Labor, and Social Domination: A Reinterpretation of Marx's Critical Theory* (Cambridge: Cambridge University Press, 1993), 173.
25. Ibid., 172.
26. Ibid., 175.

Biography

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Mapping How Worlds Come to Be

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Abstract
The notion of 'worlds' has gained much traction in recent discourses. Across the sciences, humanities and arts, including architecture, studies centring on 'worlds' aim to establish a new condition for theorising systems and their wider entanglements. Especially in architecture, there is a plethora of studies that often use a cartographic approach to chart various material (trans)formations of planetary spaces, and/or the wider discourses on spatial practices that may serve as the basis for theorising and practicing towards other possible worlds and futures. In this review I attempt to further these inquiries into spatial production by such 'other' means, by calling for a complementary posthuman account in which, following Braidotti, environmental, social, and technological transformations can no longer be understood in isolation. Here, I argue, it is necessary to resume and extend Foucault's initial call to subsume the formation of built environments (and the various practices that create them) under the general history of technē, here generalised in terms of (cultural) technologies and cosmotechnics. With this aim, the following discusses theoretically-grounded approaches through the spatialisation and coupling of (cosmotechnical) difference.

Keywords:
Worlding, built environments, posthumanism, cosmotechnics

The notion of 'worlds' has gained much traction in recent discourse. Against the universalising and ubiquitous idea that we all live in a single world instituted by western historiography and its 'one-world model' of development, studies across many fields now critically analyse and contest the ways in which a diverse planet has, through centuries of colonisation, imperialism and global capitalism, become increasingly impoverished and homogenised, by erasing difference. Through a more pluralistic notion of 'worlds', these studies employ the Zapatistas' slogan to safeguard and re-create a 'world of many worlds' in promoting what we could call with Arturo Escobar a more 'pluriversalising' stance.[1]

Across the sciences, humanities and arts, including architecture, studies centring on 'worlds' aim to establish a new condition for theorising systems and their wider entanglements by way of constitutive differences, asymmetries and inequalities, and thus think about constitutive and transformative relations.[2] Especially in architecture, there is a plethora of studies that use a cartographic approach to chart various material (trans)formations of planetary spaces and the wider discourses on spatial practices that produce them. Thus often foregrounding verbs like 'making' or 'constructing' worlds, they analytically attend to alternative and emancipatory social and

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spatial practices or other(ing) spaces. This aligns with their often feminist, queer and decolonial aim to reclaiming a number of minoritised or othered subject positions and perspectives, which may serve as the basis for theorising and practicing towards other possible worlds and futures.[3]

In this review I attempt to further these inquiries into spatial production by such 'other' means, by calling for a complementary posthuman account that re-examines the ways in which technics mediate – and always have – between social and environmental formations. As Rosi Braidotti argues, in the present condition, environmental, social and technological transformations can no longer be understood in isolation, and mapping the socio-techno-environmental entanglements that shape our world requires a more transversal approach.[4] Based on a Félix Guattari's transversal understanding of the way architecture – as a technology recursively producing culture – intersects these three dynamics, scholars including Hélène Frichot and Peg Rawes started to re-consider architecture as an ecology of practices that engage in the purposive transformation of co-constitutive habitats, habits and modes of inhabiting worlds.[5] Understood as both critical and creative, material and discursive, these practices can no longer be understood as taking place *in* space or the world. Rather they must be conceptualised immanently as taking form *through* spatialisations that are constitutive of worlding dynamics, and ought to be mapped as such.[6] Here, I argue, it is necessary to resume and extend Foucault's initial call to subsume the formation of built environments (and the various practices that create them) under the general history of *technē*, here generalised in terms of (cultural) technologies and cosmotechnics that enact and constrain them.[7] After introducing the notion of wording (practices) in more detail, I discuss a few theoretically-grounded approaches and alternative ways of mapping how worlds world worlds through the spatialisation and coupling of (cosmotechnical) difference, and reconceptualise the role of architecture therein. As I conclude, reconceptualising architecture as a worlding practice presents a radically inclusive stance for engaging cosmotechnical difference in mapping how worlds come to be.

Worlding and worlding practices

Having emerged in the context of a particular critique of cartographic representation, the neologism 'worlding' was popularised by Gayatri Chakravorty Spivak's postcolonial call to critically study the worlding of the so-called Third World. To recuperate the subaltern subject position and modes of being in the world, Spivak adopted and adapted Heidegger's notion of worlding as an ontological concept to describe the 'presencing' of an environment that exists in constant processes of transformation, and within which all beings are constructed from ongoing dynamics.[8] Oppositional modes of thinking conceive of beings as merely existing *in* the world, akin to container conceptions of things in space. Worlding focuses instead on processes, events or dynamics through which certain things or beings are brought about, brought into existence, or render certain beings visible and thinkable, while also concealing and rendering others invisible and unthinkable.[9]

Pheng Cheah has further argued that a world is precisely that which cannot be represented in maps. Cheah here mainly critiques the way cartographic modes 'epistemologically construct the world by means of discursive representations' by 'reduc[ing] the world to a spatial object'.[10] Building on this critique, Neil Campbell's book *What Worlding Does* investigates worlding in terms of constructive processes and calls for studying dynamics and modes of temporalisation without reducing this temporal dimension to an effect of things *in* space.[11] To evade the still-oppositional relation between the colonial logic of world-making against which Cheah proposes minor forms of 're-worlding' or 'counter-worlding', Aihwa Ong calls for approaching worlding non-ideologically. Through the term 'worlding practices', she approaches worlding in terms of situated practices that shape alternative social configurations. In this view, wording becomes 'linked to the idea of emergence' insofar as it 'remap[s] relationships of power at different scales and localities'.[12]

Material-discursive worlding dynamisms

Ong's situated understanding of worlding (practices) here converges with Braidotti's conception of cartography as a theoretically powered and politically informed reading of the present. By revealing the webs of power relations we are all entangled in, cartography can assist in bringing forth alternative figurations based on embodied, embedded, relational and affective perspectives and visions.[13] Ong's closer focus on *con*figuration processes adds a more spatio-temporal aspect in approaching worlding practices from different dynamics of spatialisation within various spaces of flows or milieus.[14] Thinking through milieus foregrounds actual morpho-dynamic processes operating simultaneously at and across different levels of organisational complexity, and configures individuations and becomings. Karen Barad's reading of apparatuses (*dispositifs*) famously elaborates how physical phenomena come about through particular reconfigurings of the world which Barad calls 'boundary-drawing practices'. These 'cut together/apart' new matters and meaning in co-constitutive ways and, as such, present material-discursive practices.[15]

Understood in terms of the material-discursive apparatus, architecture and built environments can then be said to 'cut together/apart' socio-techno-environmental dynamisms in particular ways that generate particular social realities and subject formations. Yet, such a vision calls not only for a fundamental critique of how we conceive such systems in their irreducibility, but also for challenging the reductive terms of the discussion. As Braidotti's post-humanist reading of socio-techno-environmental relations warns, a greater problem concerns any reductive reading of technology as presumably doubly-opposed to 'nature' and 'culture', which may invite transhumanist perspectives. To further a transversal vision, decolonisation is needed to challenge Western ontological presuppositions and hierarchies. Aligning here with Braidotti and Barad, Walter Mignolo has most powerfully critiqued the ways in which Western cosmology enacts a representationalist system of knowing (epistemology) that privileges beings, objects or transcendent ideas to which relations become secondary, while many other cosmologies start from the primacy of relations.[16] Furthering the aforementioned focus on minor positions, to map worlding practices thus generally requires adopting a stance that maintains the primacy of relations in the way worlds, things, objects and subjects come to be.

How worlds world worlds

Reconceptualising the ways in which relations shape becomings was the declared methodological aim of Deleuze and Guattari's concept of assemblages. In assemblages, architecture attains a particular configuring function. Mapping form-taking assemblages requires pinning down where and how 'an architecture' – chosen among many virtually-possible configurations – comes to organise productive relations.[17] It highlights how architectures (meta)stabilise certain assemblages by spatialising difference in particular configurations, while temporalising the constitutive dynamics and rhythms that generate and maintain them. This spatio-temporal process engenders twofold processes of machinic heterogenesis, in which asymmetries give rise to further differentiation. Such dynamics, reciprocally determining what is related to what, thus constitute mutually-constitutive relata that 'machinically' give rise to path-dependent becomings. When mapping how worlds come (or came) to be through such machinic heterogeneses, is not enough to trace transformative processes back through their spatial results. What needs mapping is what was going on, meaning what differentiating couplings of differences (or 'different/ciations') were being actualised in this formation. Aligning with all aforementioned critiques of representation, here the cartographer's task is to avoid phenomenological reductivism, insofar as the process of how worlds world worlds does not directly resemble the worlds worlded.[18]

Foucault's genealogies still struggled with representationalism in trying to render visible how in the worlding of western early modernity, its institutions, spaces, knowledge, power and subjectivities were co-produced through material-discursive dispositifs of distribution and their organisation into grids, classes, taxonomies and so on. This gridding, Kimberlé Crenshaw and others have since illustrated, has mutated into a wider and multi-layered matrix of intersecting axes of exclusion, marginalisation and hierarchisation.[19] Effectuating matrices of oppressive powers such 'hierarchising assemblages' present the very diagram (that is, a productive scheme outlined by lines) driving Western worlding.[20] Particularly in a colonial milieu, three of these axes – nature, sex and race – have intersected to form the main enunciating factors that drove the heterogenesis of 'the human' and naturalised, sexualised and racialised others co-produced and contra-distinguished by an associated milieu of discrimination. This constituted (and instituted) a problematic 'type of man' resulting from what Sylvia Wynter (after Fanon) primarily saw as a sociogenetic practices.[21] But these practices cannot be isolated from the environmental and technical reconfigurings that accompanied them. Kathryn Yusoff's essay 'Anthropogenesis', discussing the reciprocal formation of *anthropos* and 'anthropogenic' environments, describes the latter not as a mere (by-)product of the former but as a means by which specific types of being are generated and sustained.[22] As Anna Tsing further notes, the particular mode of production behind 'man-made' environments widely reduces complexity, diversity and liveability in favour of impoverishing landscapes that monotonously produce and reproduce the same.[23] In this sense, the very architecture of these 'anthropogenic' environments must be understood as a differentiating factor in a process of machinic heterogenesis, which gave rise to and configured a particular world through its reticulated socio-techno-environmental organisations and ecologies of material-discursive practices.

Positing that such differentiations are fundamentally inscribed into (or flattened out from) evolving systems, the philosopher of technology Bernard Stiegler subsumed the process of anthropogenesis into a wider evolutionary process he called epiphylogenesis. With this term, he theorised the way (not just human) life co-evolves largely 'by means other than life', recognising one of the decisive mediators in technics. For Stiegler, technics constitute a third kind of memory that is retained in the organisations of the inorganic. By coupling genetic and epigenetic memories, epiphylogenetic memory enables path-dependent evolutions in which species memory is

produced and passed on along specific becomings and worldings.[24] Tending to foreground the way life forms shape and design their worlds, studies attended less to how those worlds act back on the life forms, (re)shaping them in turn. Understanding this reciprocal process in which life forms don't simply adapt to their environments but to their own environment adaptations, lies at the heart of any critical transformative engagement with the planet's present and future.

Both Yusoff's and Stiegler's theorisations imply 'sympoietic' processes. Popularised by Donna Haraway, the notion stresses that nothing ever makes itself; things only ever emerge (and become) *with* co-constitutive (non-human and non-organic) others, including technics, which come to act as mutual scaffolds in processes of developmental sympoiesis.[25] Worlds are always worlded *with* and *by means of* all sorts of (non/organic) others, which they come to integrate or be entangled with. This process requires a careful examination insofar as it often includes some forms of life or life worlds evolving at the expense of others. For instance, it calls for problematising how (different) technics (and the hierarchising assemblages they form) make us human to different degrees, and disindividuate or even dehumanise in different ways.[26] It begs the question: if worlds co-emerge through processes of machinic heterogenesis, then *how* do couplings of differences, inequalities or asymmetries that drive them come to be instrumentalised, or 'technicised' within co-evolving socio-techno-environmental organisations? And what modes of subjectivation and becoming do these technicities, tooled for different ends, engender?[27]

Worlding(-with) cosmotechnical difference

Creating other possible worlds or a pluralistic world of many worlds, we may conclude, thus seems to first necessitate a kind of 'worlding theory' concerning what architecture does (or can do) within epiphylogenetic/sympoietic processes. To outline this theory, environmental design needs further reconceptualisation as a cultural technology intersecting with socio-techno-environmental ecologies, to view it as an ecology of worlding practices that – as I would argue – technicises coupled differences.[28] From an assemblage-theoretic perspective, this technicity resides in the (re-)configuring function in how – across differently-scaled and trans-scalar assemblages from tools, to buildings, to cities – spatialised and spatially-inscribed differences come to act as differentiating developmental scaffoldings for their recursive and path-dependent (co-) evolutions.[29] Design here taps into a 'space of possibility' associated with any given system, so that 'other/different' possibilities may be realised.[30] Feminist, queer or decolonial calls for other modes of constructing and collectively structuring the world – starting from a radically inclusive vision of otherness that (re-)situates life in a field of multiple co-constitutive differences – instead hope to open up entirely different spaces of possibilities to transform disindividuating socio-techno-environmental entanglements into emancipatory worlds yet-to-come.[31]

A further cue for such a transformative theory may lie in Yuk Hui's proposition that worlding is possible only through technē and akin 'cosmotechnics'.[32] Hui's latter notion calls for a fundamental transformation of 'monotechnological' thought (limited to the Western-Greek conception of technē) into a technodiverse multi-logics that – as Luciana Parisi and Ezekiel Dixon-Román comment – accounts for the ways in which cultures elaborated various metaphysical spaces by means of other cultural technologies enabled and constrained by differing cosmologies.[33] This account mirrors pluriversalising calls for an 'ontological reorientation of design' (understood both as technē, but as just one cosmotechnics) to move from dualistic-hierarchical models to relational-heterarchical ontologies of difference.[34] Such a reorientation may itself depend on an epistemological shift, discarding all forms of representationalism in favour of diagrammatics and perspectivism, and ultimately depends on an ethical reorientation of theory-practice. We may thus be advised to adopt a generalised ethico-onto-epistemological stance to revisit built environments, their organisation and genesis in terms an ecology of material-discursive practices enabled and constrained by cultural techniques, technicised environments and the machinic phyla they form. From this epiphylogenetic angle, any cartographic exercise of comparatively mapping how worlds come (or came) to be, recursively studies these processes 'otherwise' and the other way around; namely, by means of the constitutive spatial (trans)formations and differentiating spatialisations that establish different socio-techno-environmental assemblages, and in terms of worlds worlded-with and worlding-with cosmotechnical difference.

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Notes

1. Marisol De la Cadena and Mario Blaser, eds., *A World of Many Worlds* (Durham, NC: Duke University Press, 2018); Arturo Escobar, *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds* (Durham, NC: Duke University Press, 2017).
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26. Gorny and Radman, 'From Epiphylogenesis', 14.
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28. Gorny, Kousoulas, Perera and Radman, introduction to *Space of Technicity*, 4.
29. Gorny and Radman, 'From Epiphylogenesis', esp. 6–8; and Gorny, 'Reclaiming What Architecture Does', esp. 196–8.
30. Gorny, Kousoulas, Perera and Radman, introduction to *Space of Technicity*, 5–9.
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32. Yuk Hui, *Art and Cosmotechnics* (Minneapolis: University of Minnesota Press, 2021), 91; and Hui, 'On Cosmotechnics', *e-flux* 86 (November 2017), https://www.e-flux.com/journal/86/161887/cosmotechnics-as-cosmopolitics/.
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Biography

Robert A. Gorny is a scholar and lecturer in architecture theory at TU Delft. His transdisciplinary research combines historically grounded scholarship with an assemblage-theoretic extension of genealogical accounts, as developed in his doctoral dissertation, 'A Flat Theory: Toward a Genealogy of Apartments, 1540–1752' (TU Delft, 2021). Currently he is extending this approach towards a general organology of built environments, their organisation and genesis. As a member of the board of *Footprint*, he recently co-edited an issue on Bernard Stiegler's related concept of epiphylogenesis (2022).

Placing Technology: An Interview with Yuk Hui

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Abstract
In this interview, the editors met with Professor Yuk Hui, the originator of the notion of cosmotechnics, to discuss the implications of cosmotechnical thinking for architecture, urbanism and design. While Hui's work contains strong implications for architecture and spatial disciplines, he has rarely addressed them directly. In this far-ranging discussion, Hui brings together diverse topics, including the philosophy of Lewis Mumford, the cross-cultural history of cybernetics, and technology's connection to sacred space.

Keywords
Cosmotechnics, technology, cosmology, architecture, worlding

Yuk Hui is a philosopher currently based in Rotterdam, where he is professor of philosophy at Erasmus University. Being a wanderer in the past decades between Asia and Europe (Hong Kong, London, Paris, Berlin, Hangzhou, Tokyo, Rotterdam) – a situation resonant with what he describes as *Heimatlosigkeit* in his new book *Post-Europe* (2024) – Hui developed a deep familiarity with both Western and Eastern philosophy. His 2016 monograph titled *The Question Concerning Technology in China* proposes the radical concept of cosmotechnics and explores its possibilities through an ambitious reappraisal of the history of technological thought in China. Hui's work responds to a number of active debates in philosophy and the humanities, such as the ontological turn, cosmopolitics, eco-modernism, postcolonialism and transhumanism. Though it connects to a number of analogous debates in architecture and spatial disciplines, such as preservation, geo-engineering, or the homogenising effects of global capitalism, the implications of cosmotechnics have not been thoroughly considered in architectural and urban discourse. We spoke to Yuk Hui to hear his thoughts on the implication of cosmotechnical thinking in the fields of architecture and design.

Editors: It's clear to many of us that the notions of technodiversity and cosmotechnics have profound implications for thinking about the intersection between the philosophy of technology and design disciplines such as architecture and urbanism. But how exactly should we think about their connection?

Yuk Hui: Not being a scholar of architecture, there are few concrete things that I can say. But, let me try to make a couple of connections. First of all, as we know, a shelter, a cave or a house is one of the earliest forms of *spatial* and *technical* adoption of the environment (and not

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simply adapting to it), and there have been long histories. Architecture obviously implies different forms of technics or technologies. If you look at historical buildings and so on, there have been different technologies employed in different geographical regions. What are the implications of these technologies for us today in thinking through what I called technodiversity? How could we, from the perspective of architecture, begin to think about such a diversity? Today, because of globalisation, or better, planeterisation because globalisation, as we were said, had come to an end, which is officially announced in the trade war between the USA and China, we tend to be synchronised to use a standard way of building and urbanisation. This culminated in what Rem Koolhaas called 'the generic city' two decades ago – that cities everywhere will look like airports, a universal model of urbanism; now this discourse is succeeded by that of smart cities, in which cities will be built for automation, but not vice versa.

The second point is that architecture is about living, about how to dwell in a *place* (in contrast to space), and this implies many other considerations, such as cultural, aesthetic, cosmological and geographical factors. Architecture is not only about a material construction, but rather it is a large constellation of various relations between different agencies. These relations could easily be obscured and even eliminated, but they should be projected into the future because they enrich our knowledge about living instead of promoting a form of life determined by consumerism. Today, this diversity is very much ignored because of the emphasis on functionality (which is itself mostly determined by industrialism, consumerism, tourism and so on), though at the same time, we also see many other architectural manifestations in order to address this impasse. When I was in Lisbon in the early summer, I passed by Kengo Kuma's new project at the Centro de Arte Moderna, and I was enchanted by the motto on the wall of the construction site 'we are living in the era of the garden not of the architecture'. Garden is one way to look at these relations; at the same time, there are different gardens – Chinese gardens, Japanese gardens, European gardens, etcetera; they all express these relations in different ways and give different weights to them.

Editors: The concept of cosmotechnics has a strong methodological value, because it implies a different way of thinking about history. There has been considerable overlap between the history of architecture and the history of technology – both in their content and methods. Could you say more about what cosmotechnics means for our understanding of history?

Yuk Hui: I don't pretend that I know much about architecture, let me just start with something obvious: In the twentieth century, the history of technology as well as the history of architecture and the arts was very much determined by a materialist understanding. For example, the emergence of new materials such as iron changed the facades of many buildings in Paris, and later glass brought in a new relation between housing and light. So, one could of course read the history of the arts, the history of architecture, and more, through technological progress or more precisely technological determinism.

One cannot ignore the profound analysis from a materialist point of view, for example in the work of the palaeontologist André Leroi-Gourhan, who explains the strong agency of matter in the invention of tools. Also, in the domain of media, this was of course already explored by Walter Benjamin and the tradition that followed him, in order to understand the radical transformation brought to us by technology. For example, Benjamin rightly pointed out that it is not productive to ask whether film and photography are art or not. Rather, one should ask in what ways these new technologies change the nature of art itself.

On the other hand, this strong materialist, sometimes even Marxist point of view might have been revolutionary in the twentieth century; today such claims seem to me to be quite obvious or even banal. This materialist perspective is very limited as a form of historical analysis, though Marx himself is far more complicated than this. That is the reason that I wanted to bring forward a more comprehensive way to understand the history of technology. Technology, of course, because of its material nature, has enormous agency in determining social and cultural development. But at the same time, through what I call cosmotechnics, not only the cosmological, but also aesthetic and other kinds of thinking also have an important role in the development and uses of technology.

So in a very broad sense, what I'm trying to do is to depart from the materialist reading, which implies a kind of technological determinism, and move toward a different framework where we could think of other ways to deal with technological progress. And maybe in my own words, I would say to find a *place* for technology. That is, not simply let technology determine what is to come, but to situate or to place technology *through* the other, and *with* other ways of thinking, be they religious, aesthetic, philosophical, socio-political.

Simondon, in *The Mode of Existence of Technical Objects*, after he analysed the evolution of the technical object and the relation between the human and the world mediated by technology, recognised that this analysis was still not sufficient. We have to think about the genesis of

technicity. That is to say, we must understand the genetic relation of technological thought to other kinds of thought, and we should not simply take the technology as the sole determining force in historical development. This opens a new methodological approach to technology, which still needs to be further elaborated.

Editors: It's good that you bring up Simondon. His concept of technicity, and his articulation of the reticular relationships between technologies, environments and users is something that a number of contributors to this issue pick up.

In a recent lecture at Princeton, you present Simondon as one of the philosophers whose work has invoked a notion of bifurcation, along with André Leroi-Gourhan, Henri Bergson and Lewis Mumford. Mumford, one of the great historians of both technology and architecture, wrote about the opposition between mechanistic and organic tendencies in technology. Could you talk a little about what role Mumford's thinking has played in your work?

Yuk Hui: The title of my last book, *Art and Cosmotechnics* (2021), is a reference to Lewis Mumford's 1952 lectures that were later published as *Art and Technics*. I also engage with him extensively in my new book *Machine and Sovereignty* (2024), in which his concept of the megamachine is central. Nevertheless, I am also critical of Mumford's work, because I think he belonged to a generation of the twentieth century that tried to confront the technological civilisation with a fantasy of organism, or more precisely, of an organismic operation of society. Mumford thought that if we could understand society in an organismic way, then we may be able to overcome industrialism, which he saw as the source of the devastation of the nineteenth century.

What does Mumford really mean by organism? How was this opposition between organism and mechanism established? And how valid is this opposition today? These were the questions that I tried to deal with in my book *Recursivity and Contingency* (2019), where I claim that one way of reading the history of modern philosophy is to understand it through the opposition between mechanism and organism.

In the seventeenth and early eighteenth century, Europe was dominated by mechanism, which we can identify with many great philosophers such as Descartes. But in the second half of the eighteenth century, we see the emergence of the kind of counterargument against mechanism, namely organism. From Kant on, we see that this opposition between mechanism and organism is everlasting. Bergson, Whitehead, and Mumford actually belong to the late stage of the historical period of thought based on this opposition; Mumford also refers frequently to Whitehead as his theoretical authority.

This is how I understood the theoretical background of Mumford's criticism of technology. But this seems to me to be rather simplistic. In many of his works, for example *Art and Technics* and his major work on political thought *The Myth of the Machine*, we encounter a concluding proposal to model culture according to an organismic form, including both architecture (he gave the example of Frank Lloyd Wright, and we might find it later in Japanese metabolism and others as well) and the megamachine (which he calls the new *organum*). The megamachine refers to what I would call political form, for example, the polis, empire, monarchy, the modern state. Mumford opposes this organic megamachine to the mechanical megamachine, namely the Hobbesian absolute monarchy.

We then arrive at the question: Is this opposition still valid today? In the second half of the twentieth century, cybernetics claimed that the opposition between mechanism and vitalism had already been overcome, because machines were now able to simulate the behaviour of organisms. We find this claim not only in the work of Norbert Wiener, the founder of cybernetics in 1948; but also in Simondon's reading of Wiener, when he said in 1958 that machines are becoming organic. Note that Mumford was aware of Wiener's work, but he holds two different attitudes to Wiener's cybernetics and Walter Cannon's homeostasis. Today, with the rise of artificial intelligence, bioinformatics and so on, this opposition seems to become ineffective, since the technology of our time cannot be reduced to the kind of mechanism of Descartes. This is a major problem in the critiques of ChatGPT, as some critics claim that the ChatGPT AI is still mechanistic, whereas humans and human thinking are organic. This is, in my view, an epistemological mistake.

But how can we move away from this? It seems to me that we need to liberate our epistemological understanding from the opposition between mechanism and organism, which only truly belongs to a specific moment in European history. However, this doesn't mean that we should look for another candidate, such as vitalism, but rather that we should aim at a radical opening of the question of epistemology towards different ways of knowing, of interacting with non-human beings.

Although Mumford provides rich historical expositions of the subject, there are limits to his theoretical framework. It's also important to note that this way of thinking persists and is not limited to Europe. Today, if you ask some Asian philosophers, what is difference between Western thought and Eastern thought, many will still tell you that the difference is that the East is organic, and the West is mechanistic. The fact is that in Chinese thought, such an opposition

was only adopted by the Chinese intellectuals and the sinologists in the early twentieth century, for example, in the theory of medicine, martial art, and so on.

Editors: Cybernetic ideas have had a profound effect upon twentieth-century urban thinking, particularly in the post-war United States. This cybernetic view of cities has become deeply entrenched all over the world, but has reached something of an apotheosis in present-day China. What do you make of this development?

Yuk Hui: Perhaps the most significant development in urbanism, not only in China, but beyond, is the idea of the smart city. Leaving aside Mumford's organic architecture, the thing that could really automatise the part-whole, and part-part relations of the city are digital computational networks. This brings us to questions of resilient infrastructures.

Infrastructure becomes something very significant in the late twentieth century. As some authors have observed, if we look at the Euro, we no longer really see human figures on the money – only infrastructures. You see arcades, bridges. Today, it is not Churchill, not Thatcher, not Biden, but rather infrastructure that is the true embodiment of power.

The acceleration of 'smartness' is much stronger in East Asia than elsewhere. We see this, for example, in the ubiquity of digital payment systems which are integrated in communication, transportation, and so forth; also the deployment of auto-pilot cars, since this involves the reconstruction of the road systems to minimise accidents. There exists an imperative of modernisation, which is itself a historical consequence of China's tragic confrontation with the West 150 years ago. This imagination is deeply rooted in European modernity and consciously carried further in the geopolitical world through increasing competition.

Editors: Time, or temporality, is a significant theme in *The Question Concerning Technology in China.* Your argument there is heavily concerned with axes of time – their synchronisation, convergence and possible bifurcation. A crucial factor in the development towards technological singularity is an erasure of diverse relationships to time. The infrastructures that you just described are part of a cybernetic paradigm that has greatly accelerated this erasure.

At the same time, the history of cybernetics is anything but unitary. It contains complex and contradictory trajectories across many different localities. In architecture, there have been a number of cybernetic experiments, such as interactive environments, responsive environments and 'soft architecture', which deploy very different concepts of time. Do you take these multiple histories into account when you talk about the intellectual legacy of cybernetics?

Yuk Hui: This is a complicated conceptual issue, and it also depends on the method we use to study the history of a discipline. Since the beginning cybernetics was identified as a universal science, a universal way of grasping the operation of the world but also unifying other academic disciplines. There are two key concepts in so-called first-order cybernetics: the first is feedback; the second is information. We see feedback in almost all phenomena, whether natural or social. The psychologists, neuroscientists and computer scientists involved in the cybernetic movement were all very much inspired by the concept of feedback. The Cartesian mechanism, by contrast, has no concept of feedback due to the linearity of the mechanistic reasoning.

Norbert Wiener once said that if we look at Chinese cosmology and its implications for politics, it is actually a feedback system: the emperor could be punished by the heavens for doing wrong. The heavens act as an algorithm of a moral feedback system. But later, of course, we see that the term feedback also gave rise to the concept of recursion in so-called second-order cybernetics. This concept was central to the later work of Gregory Bateson (who speaks about a recursive epistemology), and as well as to Von Foerster's *Cybernetics of Cybernetics* and Niklas Luhmann's *Society of Society.*

What interests me is the transition from the concept 'feedback' to the concept 'recursion'. This is because it leads to different observation systems, different models of interaction and so on. British cyberneticists like Stafford Beer also talked about the power of recursion. So that, for me, is the essence of cybernetics: an idea of how to grasp the whole and how to understand the interaction between the whole and different parts in terms of recursive movements, determined by a certain telos. This basic epistemological question and the unified model might be undermined when we look at cybernetic projects from a macroscopic view, for example, a national economy. There have been experiments in cybernetics in the US, in the Soviet Union, in Latin America, in China, Poland, and so on; I have documented these in a book I recently edited titled *Cybernetics for the 21st Century Vol. 1: Epistemological Reconstruction* (2024). The book tries to provide a retrospective view of the development of cybernetics in the twentieth century, the various nuanced understandings, and the failure of appropriating cybernetics in different regions of the world beyond the US. However, I don't know enough about architecture to go through those experiments you mentioned.

Editors: In *The Question Concerning Technology in China* you discuss the work of Tim Ingold who, as you note, has also proposed a unity between practices and the environmental milieu in his concept of 'sentient ecology'. You warn, however, that Ingold's analysis, which is based on a particular reading of Bateson's work, risks reducing humans and their environments to a cybernetic feedback model, overlooking 'the absolutely overwhelming and contingent role of the cosmos'. Can you elaborate on this?

Yuk Hui: In fact, I responded to this in a comprehensive way in an article published in 2020 called 'Machine and Ecology'. As I said earlier, it has been suggested that cybernetics has already resolved the problem of dualism. If the critique of modernity begins from a critique of dualism (of body and mind, human and animal, nature and culture, and so on), can we then say that we have in fact already resolved the problem of modernity, or at least that cybernetics, as a unitary logic, shows the way out of modernity? Today many people still use this dualism as a way to critique our contemporary situation, arguing that our social, political, cultural problems stem from our dualist ways. But in fact, cybernetics has already brought about a non-dualistic paradigm.

However, even with the concept of feedback, cybernetics failed to consider the question of locality. This is obviously important when it comes to architecture, because a building is always built in a locality or a place, not in a generic space. In the wake of globalisation, of course, we believe that there is only space and not place – meaning that our spaces could be homogeneous. Now, we have completely overcome the obstacle of place or distance. Electronic transactions happen across the world at the speed of light. For many people, especially economic planners, place is no longer a question, because we have achieved a kind of conquest of space. But that we've given up the question of place is one of the biggest mistakes of our time. This is one of the limits of cybernetics. And that's why I wrote that Ingold's reading of Bateson stops at the very appealing but limited model of feedback between humans and the environment. What I was trying to say is that we must take into consideration the question of locality, rather than relying on a generic model based on feedback. Today, the most important question for us is how to *place* cybernetics: how do we put cybernetics in its proper place by considering the question of locality? Because the question of place has to do with the sacred, with geography and so on.

Although he doesn't mention him by name, Simondon was heavily influenced by Mircea Eliade's *Images and Symbols,* in which he claims that place is not homogeneous. Rather, some places possess a kind of sacredness. However, this concept of hierophany has been disappearing throughout the process of modernity. For Eliade, when we look at a locality, for example at a specific region, there are always some places that have a kind of magical power. For example, an old tree, a gigantic rock, the source of a stream, or the summit of a mountain. These are places that are energised with a certain kind of magic power. A region is then not a homogeneous space, but rather a constellation, a network of such magical places. It doesn't mean that we should and could return to this original magic unity, since it is impossible; but it is important to recognise the heterogeneity of places. These are the aspects that are not taken into account in the cybernetic feedback model. Cybernetics as a theoretical model is still something that tries to provide a universal solution to all things. But we know that there is no such thing – there is no universal solution. Cybernetics, as something that can overcome a dualistic logic, must necessarily be situated in a place, that is, in a locality.

Editors: Postcolonial discourse is one of the core subtexts to cosmotechnics, especially with regard to this question of locality. You've written that postcolonial theory has been limited by its fixation upon narrative, a preoccupation that obscures technology's material reality. On the other hand, cosmologies are forms of narrative, and are largely inseparable from the myths and stories by which they are known and communicated. We find this interesting, because stories and narratives say as much about an imagined future as they do about our supposed past, and so have implications for articulating alternative futures (perhaps the core agenda of cosmotechnics). What is the place of story and narrative in cosmotechnics?

Yuk Hui: In *The Question Concerning Technology in China*, I was not trying to criticise narratives in general. Instead, I was trying to critique a particular kind of postcolonial thought, which sets out with the good intention to challenge universalism. These critiques foreground alternative myths, different narratives, in order to show that the universal is more or less an imposed hegemonic order.

While this universalist critique was particularly important in the twentieth century, we quickly arrive at another question: how should we embrace relativism? And is relativism an answer to the problems we have today? We are well aware of the problems that relativism entails. If a country or a state commits an injustice, for example abusing women, it can simply claim that this is its culture and tradition, and others should not intervene. Such a relativism may in fact provide an excuse for expansion, exploitation, and social violence, mirroring universalism. We need to challenge universalism, but we also have to confront the

problem of a reactionary and superficial relativism. This is an unresolved question and it's a very important one in the twenty-first century.

The second problem with this emphasis upon narrative is that it can only produce a difference based on identity, and it is not yet able to produce a true difference that can drive historical progress. And it doesn't allow us really to move away from modernity or to overcome modernity. For example, creating different kinds of technologies that are not Eurocentric, and that allow us to respond to our local problems, goes beyond a difference in identity.

Therefore, my book on China is actually not only about China – it only uses China as an example in order to suggest that it's possible for us to imagine a technodiversity or a multiple cosmotechnics to come, based not in a difference in identity, but rather a difference of worlding. This is not yet a solution (since there is no solution as such), but it appears to me to be the beginning of an attempt to address the problems that we are confronting by bringing technology to the fore. That is to say, to depart from the discourse on identity (which is also a bio-political technique)– whether national identity or postcolonial identity – and move toward the construction of new kinds of community, and new understandings of historical development. This relates to my earlier point about placing cybernetics in a locality. Can we use these technologies today, for example, to build forms of community that allow us to address these problems? But instead, everyone continues using Facebook or Twitter – this is a very concrete question.

This is why I say that we have to deviate from a narrative of identity towards a construction of technological difference, which will give us more agency to respond to the problems we are confronting today. And in saying this, I don't mean to devalue or reject the efforts of postcolonialism. I believe that in the twentieth century it was very important to challenge universalism, which, especially after the Second World War, was dominated by the European knowledge system. But such a critique needs to be renewed.

Editors: What do you make of the various 'futurisms' (Afro-, Sino-, and so on) on which you sometimes draw in your work? Do you think they avoid the trap that you just described of the 'identity-centric' responses to questions of technology and difference?

Yuk Hui: Today many people don't really like reading, but they like making claims about things they don't know – a symptom that resonates with social media. They look at the cover of the book and the table of contents, and then they come to a conclusion. Sometimes, they don't even need to see the table of contents. People assume that because I wrote a book about China in relation to technology, that I must be a Sino-futurist, or a Chinese nationalist. Or that because I engaged with Heidegger, that I must be a Heideggerian. I was trying to reread the history of thought in China from the perspective of technology that didn't exist before, and to provide a critical framework to look at the current technological development in China and beyond.

Today, it seems clear that the technological myth is more and more becoming an ideology, for example the various myths related to AI, such as AI apocalypses, robot revolts, intelligence explosion, or post-singularity governance. But if you think about the ecological crisis that we are facing, this is something much more concrete. Look at the amount of rain we had this year, at the extreme weather in the summer. We have to combat these industrial myths and propaganda and imagine different forms of technological development. I think now we should all collectively ask, what is to be done?

In the summer of 2023, I was approached by an organisation in Brazil who wanted to work with me on a project on technodiversity. One of the concerns is that Elon Musk's Starlink is now accessible in the Amazon Rainforest. It means that the indigenous people can actually use mobile phones to access the internet, and that they could buy products from Amazon.com. But what is going to happen to these people in the Amazon? What kind of social, cultural, political development is going to happen there? They could, of course, just use what is being made available to them. They could undergo the same kind of modernisation that we have already experienced. But are there other alternatives for us to think about? Are there any alternative social networks? Are there other types of community organisation? Or will they be another victim of contemporary consumerism?

For me, the question of technodiversity – beyond the question of China, beyond the question of ethnocentrism – is very important; for us to think about how to reappropriate modern technologies and to go back to the question of locality. But not the locality as identity politics, like we have been seeing in France and in Germany.

In *The Question Concerning Technology in China* I make a very bold claim: that there's no cosmology as such; there's only cosmotechnics. Because I think that if we talk only of cosmology, if we separate it as a theoretical discourse, then we reduce it to a discourse of identity; for example, that the Chinese are not born of the fault of Adam and Eve, but because of Nüwa, a goddess who created human beings out of yellow soil. These are the kinds of things written in archaeological museums all over the world. The problem is that by understanding them as mere myths, we ignore the technical nature of cosmology. Cosmology is something that allows us to orient, not only

physically on the surface of the earth, but also to orient in terms of our relation to the environment, our relation to animals, plants and other non-human beings. In this sense one should separate cosmology from astrophysics. There is a corelation between the moral and the cosmological. Thus, I gave a preliminary definition of cosmotechnics as the unification between the moral and the cosmological in technical activities.

Editors: Many contributions to this issue have connected your ideas to the discourses of worlding and world-making. Can you speak about how you connect the cosmological with cosmogony?

Yuk Hui: As we know, the Greek word *Kosmos* means world, order, and adornment. All forms of cosmology need a cosmogony in order to understand why the universe is as such. And then we see the role of myth in cosmology, for example, the Greek cosmology had a lot to do with their polytheism, and so on. What I'm trying to emphasise is that cosmogony already implies many moral values and the moral deed of God, of the divine. We find this also in Christianity, and in other kinds of mythical origins of cosmology. The cosmology then carries the trace of these moral values and implies these values in our everyday life. We find this when we look into the case in China, in Japan or other non-European countries. But we also find it in European cultures. If you look into cosmic time, cosmic movements, and so on, you find that in ancient times they regulated our everyday life – they regulated harvest time, hunting time, and so on. In other words, the ancient world, or the antique way of world-making was largely influenced by cosmic time.

Today, we use GPS, which is determined by the clocks of the satellites. Time and space are connected in a new way through the GPS system. By doing so, time is also deprived of its cosmic meaning. But does it mean that this kind of knowledge is no longer relevant? I don't think so. Instead, we need to think about our time in a very different way, especially in a society that promotes speed and efficiency and constantly produces burn-out. This is also why new-age practices and critiques of burn-out have become so popular today. There is a call to return to the countryside (for example in a recent project of Rem Koolhaas), to a different kind of temporality, where one could practice what the Greeks call *skholē* or what the Romans call *otium*. On the other hand, we have to look at history not from a unified temporal axis, but rather think of a different world history, which is not eschatological (since such time didn't exist beyond Christianity). It seems to me that in order to do so, we need a fundamental reflection on and a nuanced understanding of technology.

Editors: You've just published two new books, *Machine and Sovereignty* and *Post-Europe*, both of which focus heavily on geopolitical questions. What are you working on next? Where is your research headed?

Yuk Hui: Like my other books, these two are the culmination of many years of labour. I believe that a renewed understanding of technology must influence fields long governed by technological unconsciousness – an idea that Derrida and Stiegler strived to illuminate, often referred to as deconstruction. I have been drawn to exploring the role of technology in political philosophy, particularly given its critical importance in today's geopolitical dynamics. However, the ambition of *Machine and Sovereignty* is not to comment on contemporary geopolitics; rather, it begins with an extensive engagement with Hegel's *Outlines of the Philosophy of Right* and continues with Schmitt's theory of sovereignty and the *Großraum,* but the aim is to surpass these frameworks. It is a historical-critical study on the question of technology in political philosophy, or, if I may be so bold, a preliminary sketch of a *tractatus politico-technologicus*.

Post-Europe is an even more intimate work, responding to Jan Patočka's concept of post-Europe, the rapid rise of the extreme right, as well as the relationship between Europe and Asia, while also serving as a semi-autobiography. Currently, I am revisiting the question of artificial intelligence, a topic that has captivated me for two decades. Specifically, I aim to focus on both a critique of political economy and a critique of the faculty of desire.

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Biography

Yuk Hui is professor of philosophy at Erasmus University Rotterdam, where he holds the Chair of Human Conditions. He is the author of several monographs that have been translated into a dozen languages, including *On the Existence of Digital Objects* (2016), *The Question Concerning Technology in China: An Essay in Cosm otechnics* (2016), *Recursivity and Contingency* (2019), *Art and Cosmotechnics* (2021), *Post-Europe* (2024) and *Machine and Sovereignty* (2024). He is the convenor of the Research Network for Philosophy and Technology and has been a juror for the Berggruen Prize for Philosophy and Culture since 2020.

Unweaving the Technique: Embroidering Autonomous Landscapes

Carolina Martínez Tolosa, Héctor Tabares Rodríguez and Aura Cruz Aburto, collaborating as Diseño Detonante Experimental Studio

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Abstract
Through a critical experience of reconstruction at the Isthmus of Tehuantepec, Oaxaca, Mexico, we present various ontological components that manifest as specific cosmotechnics of this territory. These cosmotechnical manifestations enunciate singularity, resistance and emancipation.

Keywords:
Resistance, emancipation, agency, territory, recognition, ritual

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We see techniques as potential agentive actions capable of revealing their own conceptions of the world, and at the same time revealing what we ignore as we speak from different places. As Diseño Detonante, we wish to discover and spark other narratives, starting from the connection of multiple realities, territories, fictions and actions.

In 2017, we travelled to Mexico City to discuss our short film Armadillo.[1] But upon arrival, an earthquake redirected our journey to the earthquake-stricken Isthmus of Tehuantepec in Oaxaca. Here, amid a history of colonial dispossession, the indigenous Binnizá and Ikoots peoples – primarily the women among them – resist and envision alternative futures. The six months we spent in Oaxaca produced a documentary, *Lumbre en el Viento* (Fire in the wind), which explores the interwoven territories shaped by the affections and diverse life experiences inherent in the relationships, crafts and daily lives of the Tehuantepec communities.[2]

These images, taken from *Lumbre en el Viento*, represent part of the plural ontologies, relations and technologies from which we will continue to challenge dominant narratives of progress. We are thankful to the strength and collective knowledge of APIIDTT and other communities that continue to resist the unrelenting forces of neo-colonial dispossession.[3]

Lumbre en el viento reflects the complexity of cosmotechnics, where relationships with life, memories and worldviews of the territories are encoded and decoded. Yet at the same time, these relationships must also be connected and mutually transformed in order to be situated in the now.

Agency

The word ‘indigenous’ is not synonymous with lack, ignorance or obsolescence, nor does it correspond to the ‘past’. On the contrary, it is the present multiplicity of knowledge that transforms itself and transforms the present, and mobilises its own worlds and territories. After the earthquake destroyed their villages and the kitchens that sustain their sovereignty, the APIIDTT proposed, before rebuilding walls and structures, to start by rebuilding the connections within the communities and their territories. It was the women who led the rebuilding process; by coming together, sharing and joking, they wove the necessary resistances to create their own counter-narrative, against colonising and patriarchal logics. Through their agency they recognised their own community wealth and power, preserving their dignity and identity.

Fig. 1: *Agency.* Image: Diseño Detonante and Aurora Servin.

Territory

Mud, water and straw were the building materials in these communities until the arrival of concrete, which, in conjunction with a narrative of progress, overtook both ways of building and ways of thinking. Today in the isthmus people use the term ‘material’ when referring to concrete, as if concrete is the only building material possible. This idea was challenged when the locals decided to rebuild their kitchens using traditional adobe construction technologies. Many hands together mixed the earth, straw and water that came to form their kitchens. This also serves as a metaphor, reminding the people that territory is not only a physical place where we build cities or extract resources. Instead, territory weaves natural and human contexts, and is inherently tied to the people who inhabit it.

Fig. 2: *Territory.* Image: Diseño Detonante.

Recognition

The indigenous women worked together to bridge some of the fault lines caused by the earthquake, while at the same time opening new fault lines through their resistance to hegemonic, Western concepts of progress. Out of the smog that privileges Western ideals over indigenous ways of knowing, this recognition was a self-affirming act of collective healing.

Fig. 3: *Recognition.* Image: Diseño Detonante.

Ritual

Rituals are inherently tied to culture, and are what preserve the cultural wealth of a people. Ritual is what preserves a people and allows for survival. The Global North has imposed a way of thinking based in the ‘rational’, which deems indigenous rituals as uncivilised and even dirty or backwards. Although Western culture has tried to erase indigenous peoples’ cultures, languages, and histories, the people have survived. Ritual lives on and preserves memory and connections with territory. Ritual is a form of resistance. Through ritual, indigenous people assert: ‘we are here!’

Fig. 4: *Ritual.* Image: Diseño Detonante.


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Notes

1. Available at: https://techniquesjournal.com/im-explosion/.
2. Diseño Detonante, *Lumbre en el Viento*, 2017, Oaxaca, Mexico. Length: 40 min., https://www.youtube.com/watch?v=VBPoumnPuC8&t=423s.
3. APIIDTT is the 'Asamblea de Pueblos Indígenas del Istmo en Defensa de la Tierra y el Territorio' (Assembly of Indigenous peoples of the isthmus in defence of land and territory).

Biography

Hector Tabares Rodriguez is a filmmaker-designer. He says: questioning is the practice that has taught me the most, mainly because it destabilises and forces me to create other inhabitable bodies, like changing my skin while articulating experiences. I am interested in critical dialogues, dialogues that can be contaminated with other perceptions and knowledge.

Carolina Martínez Tolosa is a designer-filmmaker. She is mobilised and passionate about the ontological, political and transformative dimension of design, with a strong desire to situate design in a constellation of sociology, psychology, history and other knowledges and insights from outside the academy. She likes to imagine disobediences, and weave realities and fictions among others. She believes that caring practice is a powerful way to make theory.

Aura R. Cruz Aburto has a bachelor's in architecture from Tec de Monterrey, a master's degree in design, and she is a candidate for a doctorate in philosophy of science at National Autonomous University of Mexico (UNAM). Aura considers herself a designer-philosopher, between art, design and philosophy. Her main research interest is in the power of emancipation of creative practices, such as design and art.

Footprint is a peer-reviewed journal presenting academic research in the field of architecture theory. The journal encourages the study of architecture and the urban environment as a means of comprehending culture and society, and as a tool for relating them to shifting ideological doctrines and philosophical ideas. The journal promotes the creation and development – or revision – of conceptual frameworks and methods of inquiry. The journal is engaged in creating a body of critical and reflexive texts with a breadth and depth of thought which would enrich the architecture discipline and produce new knowledge, conceptual methodologies and original understandings.

Footprint is grateful to our peer reviewers, who generously offered their time and expertise. In this issue, the following papers were peer-reviewed: 'Celestial Resistance: Norwegian World Bank Education Project in Zambia', 'The Sea Wall and the Kampung: A Debate on Architectural Cosmotechnics', 'Shipwreck Architecture: A Speculative Hauntography', 'Cosmotechnologies of Community and Collaboration in Vandana Singh's Speculative Architecture'.

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