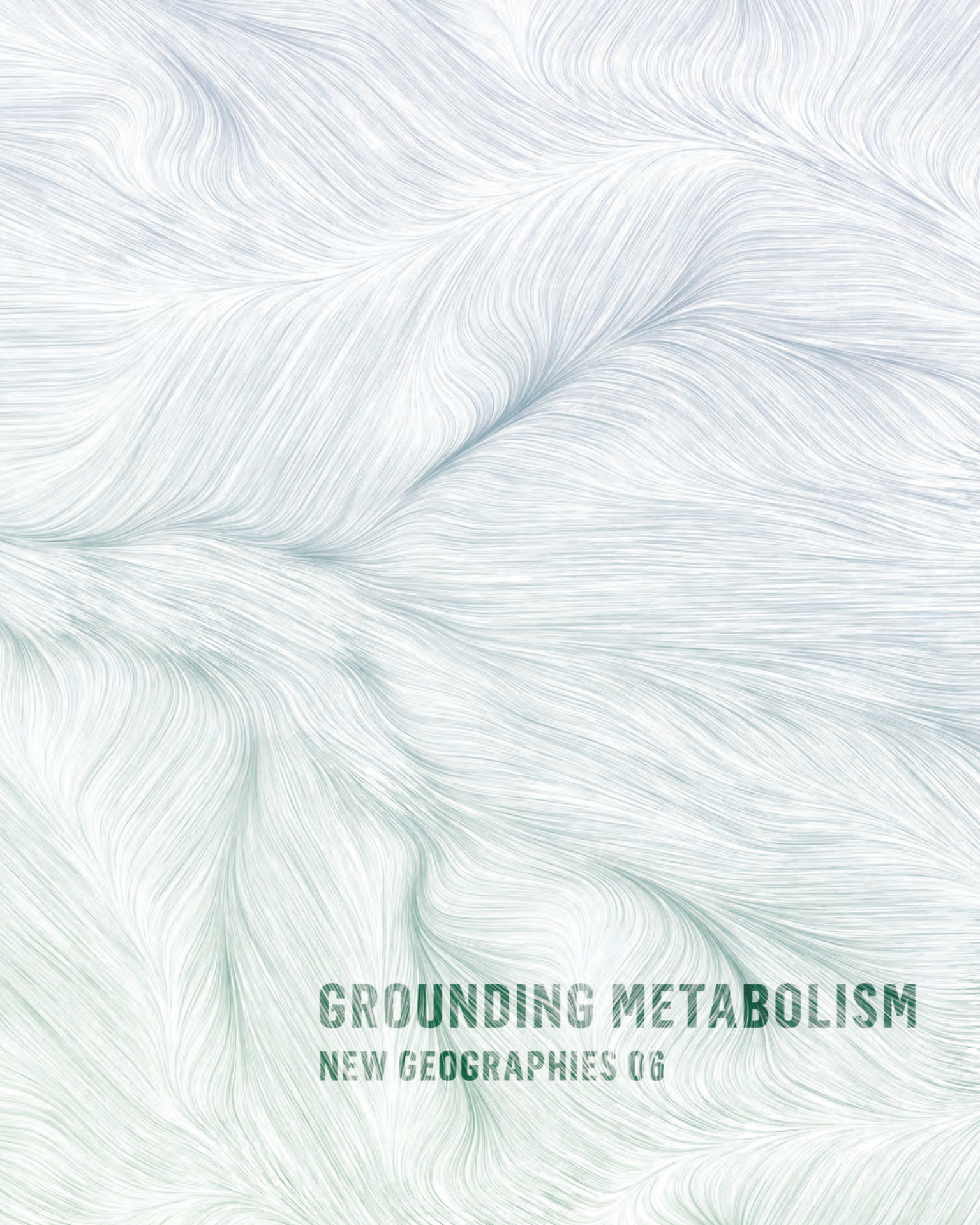
GROUNDING METABOLISM
NEW GEOGRAPHIES 06

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edited by DANIEL IBAÑEZ & NIKOS KATSIKIS

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New Geographies is the journal of Design, Agency, Territory founded, edited, and produced by doctoral candidates in the New Geographies Lab at the Harvard University Graduate School of Design. New Geographies presents the geographic as a design paradigm that links physical, representational, and political attributes of space and articulates a synthetic scalar practice. Through critical essays and projects, the journal seeks to position design's agency amid concerns about infrastructure, technology, ecology, and globalization.

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Grounding Metabolism

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NG06–Grounding Metabolism interprets urban metabolism as an inherently geographic condition, investigating the possibility for a redefinition of the context for design in a manner that can grasp both the fluidity of metabolic processes and their geographical engraving on the earth.[01]

Although design has been always tempted by the need to position itself in relation to a larger context, the engagement with (and even the definition of) this context has proved increasingly challenging. This situation results not only from the increasing complexity of urban environments–the traditional locus of design interventions–but also from the need to grasp their expanding social and environmental interdependencies across the earth. In what could be characterized as a condition of generalized urbanization, increasingly diffuse agglomeration patterns blend with a dense mesh of infrastructural networks and are strongly interwoven with expanding zones of production, supply, and disposal that cover the whole planet.[02] Where does the synthetic geography of inhabitation end? Is it just decaying with the density of population and built-up space, the transport corridors and the commuting belts? Or does it have to include the operationalization of a series of often distant but socially and ecologically interdependent territories? The vast zones of food production, resource extraction, energy production? The systems of reservoirs and hydroelectric dams? The logistical spaces of trade and circulation?

Within this condition of planetary socio-environmental transformation, the concept of urban metabolism has gained influence among scholars and designers, suggesting an analytical basis for gauging the continuous flows of energy, material, and population exchange within and between cities and their extensive operational landscapes. Metabolic approaches to urbanization promise to interweave these diverse locational contexts, allowing the investigation of the interactions among social and ecological processes in the production of urban environments, and potentially enabling designers to address a broad array of processes operating at multiple spatial scales. Most contemporary discussions on urban metabolism, however, have failed to integrate formal, spatial, and material attributes. Technoscientific approaches have been limited to a performative interpretation of flows, while more theoretical attempts to interrogate the socio-political embeddedness of metabolic processes have largely ignored their spatial registration. NG06–Grounding Metabolism suggests the need for a more explicit and systematical exploration of the geographical imprint of metabolic processes.

But the geographic structure of the metabolic organization of urbanization has been increasingly elusive over at least the last century. Historically this relationship was confined to a contiguous regional scale, with towns or cities co-evolving in a state of social and ecological interdependence with their surrounding hinterlands. Successive waves of capitalist development, the proliferation of world trade, and the development of transport infrastructures have resulted in a gradual

socio-metabolic upscaling. Under contemporary globalized urbanization, cities appear more connected to the planetary system of production and exchange than to their surrounding territories. Dissolved in the operations of logistical networks and global supply chains that reshuffle them across distant territories, metabolic processes thus often appear largely ungrounded, detached from any geographic association.

This underlying tension between the fluidity of flows and their materialization in geographical patterns of human occupation of the earth has long characterized the engagement of designers and urbanists with questions of urban metabolism. Since the beginning of the twentieth century, designers have sought to conceptualize and respond to the metabolic reorganization associated with the diffusion of metropolitanism. For influential urbanists such as Patrick Geddes and Lewis Mumford, metropolitanism suggested an exploitative operationalization of the earth that was leading to a socially and ecologically unsustainable specialization of regions, reducing them to mere utilitarian links in a world system of exchange.[03] From Geddes' valley section to Mumford's ecological regionalism, models with evident spatiality, where social and ecological processes were interpreted geographically, promoted the return to putatively more balanced, spatially confined, and self-sufficient regional forms of metabolic organization. This tension between the increasingly globalized metabolic flows and the specificities of their geographic embeddedness is further revealed in the projective attempts of Benton MacKaye and Ludwig Hilberseimer.[04] Through his "new exploration," MacKaye suggested charting the global system of resource circulation—dominated by the forces of industrial capitalism—uncovering its inefficiencies and thus allowing a reshaping of metabolic patterns according to the logics of natural geography. Conversely, Hilberseimer's "new regional pattern" proposed to counterbalance the predominant tendency of regional specialization through a less interdependent redistribution of functions with respect to the geographic terrain. This effort to (re)establish a more geographically informed territorial paradigm that would regulate or confine metabolic flows continued to be a major concern in several important strands of postwar design thinking. Examples of such engagements include the models of human association across geographic scales developed by Team 10, or the subsequent work of Ian McHarg and his ecological interpretation of the valley as a geographic unit.[05]

This geographic appreciation of metabolism gradually dissolved, however, under an increasingly technoscientific paradigm that dominated most post-World War II approaches. The fascination with a systematic interpretation of flows and the exploration of technological solutions fueled some of the most striking architectural utopias of the second part of the 20th century. The projects of the Metabolist group explored the translation of an organicist interpretation of circulation and adaptation into megastructural formations that organized and colonized territories. At the same time critical interrogations of the fascination with technology, networks and flows started questioning the detachment of architecture from the ground, as in the projects of Archigram. A series of ambitious efforts and methodologies started focusing more on the global management of flows rather than on the organization of territories. The work of Buckminster Fuller explored the agency of design as a tool for the "scientific" representation and eventually management of the global flows of resources and commodities. Fuller even advocated a complete redefinition of design practices, shifting their focus from the physical design of geographic space to the organization of the space of flows.[06] Around the same time, the large-scale simulations of the Club of Rome reports, which

built upon Jay Forrester's work on systems dynamics, reconstructed the world as a dynamic system interrelating population, resources, and development.[07] These ambitious efforts reflect the uncritical optimism associated with a general technoscientific paradigm that largely transformed urban metabolism from a question of territorial organization to one of ecological analysis and coordination of stocks and flows. The influential work of Eugene and Howard T. Odum simplified the complexities of cities and regions to a set of topologically interrelated functional elements that were measured exclusively as a transformation of energy.[08] In 1965, Abel Wolman's seminal text on "The Metabolism of Cities" called for planning to focus on the analytical investigation of flows of energy and material associated with the function of urban environments.[09]

Along these lines, under the recent paradigm of sustainable development, a tremendous amount of quantitative research has been generated in the environmental sciences to model urban metabolism. The standardization of models and indicators, such as material flow analysis or the urban footprint, has contributed to an unprecedented statistical profiling of the metabolism of cities and regions exposing the scales, dimensions, and dynamics of contemporary systems of inhabitation.[10] These approaches have remained largely descriptive, however, and blind to the underlying socioeconomic tensions associated with their geographical embeddedness. Metabolic interdependencies are rarely investigated as sociospatial constructs, but are simply presented as naturalized elements of organic ecosystems.

Over the last two decades, a set of influential critical approaches has addressed exactly this *problematique*. Stemming mainly from neo-Marxian urban geography and political economy, the concept of metabolism has been reappropriated in a dialectical manner that attempts to analyze the spatial complexities of metabolic processes in ways that also capture their social, natural, political, and technological hybridities.[11] These approaches have contributed to an understanding of metabolic processes as historically contested elements of a socially and ecologically unequal exchange within successive waves of capitalist development. Although they have been instrumental in reintroducing geography and overcoming the society-nature divide, they have been rather reluctant to supersede inherited territorial categories such as that of the "city." Consequently, such approaches have contributed only weakly to a novel understanding of extended patterns of urbanization.[12] Although both technoscientific and critical approaches to urban metabolism have been influential in design discourse, they have yet to be meaningfully connected to an appreciation of the formal organization of the expanding urban fabric, and concomitantly, to the construction of more socially, politically, and ecologically viable models of urbanism.

Within this context, contemporary design disciplines have been rather myopic in addressing the geographic dimensions of metabolic processes. A series of preoccupations, operating in parallel or in combination, seem to characterize the engagement of design with processes of urban metabolism. A fascination with the fluidity of metabolic processes has led to the privileging of design concepts focusing on adaptability, indeterminacy, and flexibility rather than the often sclerotic nature of urban fabrics, infrastructures, and territories. At the same time, within the broader sustainability paradigm, the increasingly widespread concern with quantitative questions of performance and efficiency tends to prioritize energy, material, and climatic optimization and thereby to marginalize the agency

of design. Finally, there has been a tendency for a morphological fetishization of metabolism. This attitude has foregrounded a metaphoric interpretation of fluidity and organic forms, undermining the possibility of grasping the complexities of a metabolic interpretation of context. Meanwhile, an important series of more analytical engagements has emerged in contemporary design research. On the one hand, a thematic approach has been invested in investigating specific metabolic processes, charting for example the flows of food, waste, water, and energy. On the other hand, a more territorial approach has engaged with specific functional sites of metabolic activity, such as landfills, mines, agricultural fields, and ports. Although their often-groundbreaking cartographic and diagrammatic investigations have been successful in surfacing the complexities of metabolic processes, they have yet to adequately address the full potential of their projective dimension.

Grounding Metabolism interprets design as a geographic agent that, although reflexive to the spatially transcendent systems of flows and processes, is still focused on the physical configuration of human occupation "on the ground." As a result, any valuable interpretation of context needs to be connected to this specific operation. No matter how expanded it can be, as urbanization continuously reshapes the planetary terrain, design has eventually to be connected to a site-specific formal appreciation of geography. For this reason, Grounding Metabolism foregrounds the geographical imprints of metabolic processes. Instead of a seamless, ethereal, and malleable space of flows, we aim to reveal a different, thick, heavy, and lengthy process of metabolic reorganization of the earth's surface operating at various paces and scales.

We argue that the more seamless and continuous the global metabolic system of exchange becomes, the more it is engraved in a geographically discontinuous organization of the earth's surface. As urbanized regions expand and thicken, extending their metabolic reach, they become increasingly interdependent with the development of specialized regions of service and supply (agricultural regions, resource extraction zones) and a densifying mesh of connectivity infrastructures that enables the increasing volumes of exchange. As this process unfolds, it results in the production of a series of distinctive and rather sclerotic fabrics of urbanization. The articulation of these fabrics, however, is becoming increasingly splintered as the differences inherent in the specificities of natural geography are coupled with the uneven patterns of capitalist development.[13] At the same time, almost all elements of this fabric are revealed as parts of a multiplicity of metabolic cycles operating at a series of both spatial and temporal scales, from the building to the planetary, from the daily to the geologic. On an hourly and daily basis, settlements and infrastructure systems, buildings and cities, ports and highways, dams and pipelines, mines and oil rigs, agricultural lands and irrigation networks, landfills and waste treatment plants are all are parts of a dynamic metabolism of people, energy, water, nutrients, etc. At longer time frames, they are themselves artifacts of a process of not only capital investment but also the reorganization of materials and resources that have often been relocated from distant lands, and as such of a longer-term geo-metabolic alteration of the earth.

Grounding Metabolism offers a promising yet challenging proposition. It does not suggest adopting any sort of "metabolic determinism" in which conditions on the ground are seen as the mere reflection of metabolic processes. Nor does it aim to reintroduce any sort of geographical determinism in which the organization of metabolic processes is derived from the specificities of natural geography. Rather, it aspires to uncover the complexities behind the historically path-dependent, socially

and politically contested negotiations through which metabolic processes and their geographical imprints are co-produced. It aims to reveal metabolism not as a "natural," "organic" process configured automatically as urbanization unfolds, but as a laborious and highly asymmetric effort to coordinate social and environmental systems, always mediated through the forces of capital and power. But such an approach in turn points up a series of potentials and challenges for design, including the following:

- Although the locus of design has been historically limited to urban environments, Grounding Metabolism highlights how almost every metabolic process transcends the "urban" to reach even the most remote territories of the globe, interweaving a multiplicity of sites. Rather than claiming "new" territories for design, it aims to investigate its agency in shaping their socio-ecological circulatory connections and interdependencies.

- Grounding Metabolism helps to overcome a series of historically inherited conceptual and territorial binaries—society-nature, town-country, city-hinterland—that are inadequate to describe the contemporary condition of urbanization. The circulatory dynamics of these socio-ecological processes offer an opportunity to reshuffle old binaries into new categories of analysis and intervention for design.

- Despite the contemporary fascination with the apparently weightless metabolic circulation of energy and material, it becomes evident that contemporary architectures and urbanisms are still deeply interwoven with heavy material transformations and spatially confined processes, tightly connected to the specificities of natural geography. A more informed reading of the metabolic properties of this condition could open up alternative routes to globalized design interventions.

- The geographic interpretation of metabolic processes enables the simultaneous conception of the "construction" of a site vis-à-vis "deconstruction" of others. This composite of sites and territories and their associated social and ecological transformations could offer a nuanced redefinition of the context of design, beyond traditional notions of proximity. The potentials of connecting labor, operations, and power relations with the material specificities of one site to the other is still uncharted territory for design.

- Grounding Metabolism blends the fixity and motion of material circulation. The apparent rigidities of urbanization become gradually liquefied when conceptualized as part of circulatory processes operating at variegated time frames. Long-term material rearrangements can be conceived as part of a process of creative destruction, historically mediated through capital and power relations. This framework opens up opportunities for understanding buildings, infrastructures, or land-use intensities as systematically temporal and in perpetual motion. Life cycles, differential obsolescence, or functional sequences suggest nuanced drivers for the material organization involved in (any) design.

Grounding Metabolism brings together a diverse set of contributions, offering an overview of state-of-the-art approaches to urban metabolism to highlight elements for its geographic interpretation. The first part attempts to place into creative dialogue a series of seminal approaches that are seldom presented side by side. Analytical contributions highlighting the potential for systematic and quantitative modeling and classification of aspects of urban metabolism [**Ellis** / **Baccini** / **Barles**]

are interwoven with a series of critical approaches [**Moore** / **Luke** / **Gandy**], aiming to shed light on the social and political dimensions of metabolic processes that are often obscured behind the abstraction of technical models. Under the lens of urban political ecology, these contributions highlight conceptual, theoretical, and etymological challenges in the construction of a hybrid socio-natural, geographically embedded interpretation of metabolism. These approaches also offer varied perspectives on the dimensions and challenges of the contemporary condition of global metabolic upscaling. In parallel, design questions are introduced early on with a set of historical examples attempting both a design investigation of the formalization of metabolic processes [**Salgueiro, Chugh, and Léon**] and more scholarly explorations of seminal design approaches and concepts that dominated the past century [**Welter** / **Steiner** / **Tadashi Oshima**]. The last part of the volume brings together a diverse set of critical texts [**Spencer** / **Bélanger**] and design investigations highlighting various attempts to engage with the territorial dimensions of metabolism. These include projects highlighting the emergence of neglected territories of design in the vast networks of global hinterlands [**Correa and Folch** / **Ghosn and Jazairy**] as well as studies of the challenges of reorganizing post-metropolitan forms of urbanization [**Viganó** / **de Graaf**]. Moreover, they foreground certain urbanistic attitudes to questions of self-sufficiency, ephemerality, material sourcing, and performativity [**Mehrotra and Vera** / **Guallart** / **Rahm** / **Moe**].

In this way, Grounding Metabolism offers a compilation of preliminary notes, positions, and projects to open up relevant questions for designers. It builds toward an understanding of a contemporary design context that is not merely being upscaled but is in constant circulation through the weaving together of a multiplicity of variegated geographies.

Notes

01. The investigation of the potentials of a geographic approach to design has been central not only among the New Geographies editors but also in research undertaken in the New Geographies Lab at the Harvard University Graduate School of Design under director Hashim Sarkis (www.research.gsd.harvard.edu/nglab). See also: Hashim Sarkis. "Geo-Architecture: A Prehistory for an Emerging Aesthetic," Harvard Design Magazine 37 (2014).

02. Neil Brenner and Christian Schmid have recently embarked on an investigation of planetary urbanization, stressing the need to connect analytically concentrated agglomerations and their extended operational landscapes, an agenda already generating considerable research in the Urban Theory Lab, Harvard GSD (www.urbantheorylab.net). See also: Neil Brenner and Christian Schmid, "Planetary urbanization," Urban Constellations (2012): 10–13; Neil Brenner, ed., Implosions/Explosions: Towards a Study of Planetary Urbanization (Berlin: JOVIS, 2013).

03. Patrick Geddes, Cities in Evolution: An Introduction to the Town Planning Movement and to the Study of Civics (London: Benn, 1968); Lewis Mumford, "Regionalism and Irregionalism," Sociological Review 19, no. 4 (1927): 277–288.

04. Benton MacKaye, The New Exploration: A Philosophy of Regional Planning (Urbana, IL: University of Illinois Press, 1990); Ludwig Hilberseimer, The New Regional Pattern (Chicago: Paul Theobald, 1949).

05. Alison Smithson, ed., Team 10 Primer (Cambridge, MA: MIT Press, 1968); Ian L. McHarg, Design with Nature (New York: American Museum of Natural History, 1969).

06. Buckminster Fuller, "U.S. Industrialization," Fortune 21, (2 February 1940): 50–57; Buckminster Fuller and John McHale, World Design Science Decade, Document 4 (Carbondale, IL: World Resources Inventory, 1965).

07. Donella H. Meadows and Dennis Meadows, The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind (New York: Universe, 1972); Jay W. Forrester, World Dynamics (Cambridge, MA: Wright-Allen Press, 1971).

08. Eugene Odum, Ecology and Our Endangered Life-Support Systems (Sunderland, MA: Sinauer Associated Inc., 1989).

09. Abel Wolman, "The Metabolism of Cities," Scientific American 213, no. 3 (1965): 179–190.

10. See, for example: Peter Baccini and Paul H. Brunner, Metabolism of the Anthroposphere: Analysis, Evaluation, Design (Cambridge, MA: MIT Press, 2012); William Rees and Mathis Wackernagel, "Urban Ecological Footprints: Why Cities Cannot Be Sustainable—and Why They Are Key to Sustainability," Environmental Impact Assessment Review 16 (1996): 223–248.

11. See, for example: Nik Heynen, Maria Kaika, and Erik Swyngedouw, eds., In the Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism (London: Routledge, 2006); Matthew Gandy, "Rethinking Urban Metabolism: Water, Space, and the Modern City," City 8, no. 3 (2004): 363–379.

12. Hillary Angelo and David Wachsmuth, "Urbanizing Urban Political Ecology: A Critique of Methodological Cityism," International Journal of Urban and Regional Research (2014).

13. Steve Graham and Simon Marvin, Splintering Urbanism: Networked Infrastructures, Technological Mobilities, and the Urban Condition (London: Routledge, 2001).

Daniel Ibañez and Nikos Katsikis

NEW GEOGRAPHIES

With **New Geographies 06–Grounding Metabolism**, the second generation of NG editors introduces a series of three volumes that question the dimensions and materialities associated with the geographical registration of the complex and multi-scalar social, technical, and environmental processes that constitute contemporary urbanization. In volumes 0 to 5, the primary aim of the journal was to foreground the emergence of the geographic as a paradigm that would allow design to provide a broader, more engaged, and more dialectical response to context. This investigation revealed that as designers are increasingly compelled to shape larger scales and address complex urban and ecological issues, they depend increasingly on social, economic, and ecological interpretations of space. While these interpretations typically embrace the dynamism of processes, flows, and networks, they seem to have overlooked their material imprints on geographic space. This series addresses the apparent disjunction between verifiable as well as speculative relations among processes, flows, and networks (which has dominated contemporary debates on urbanization) and their geographical imprints, whether designed or simply inherited in the physical organization of territories.

Forthcoming

New Geographies 07–Geographies of Information will investigate the emerging spatial hybridities of information and communication technologies (ICTs). Whether explicitly stated or not, contemporary understanding of these technologies is organized around a set of hybrid conditions, dealing with issues of materiality, scale, territory, and spatial politics. Digital information technologies possess physical and virtual materialities, articulated through hardware and software systems. Contemporary communication networks boast physical and human geographies, and generate increasingly intertwined public and private spaces. Yet within contemporary design discourse ICTs are rarely thought of in spatial terms, instead most often conceptualized as merely a flow to be mapped, a service to be included, or an always available cloud of information to access. ICTs and their networks of distribution nonetheless possess an uneven geography and a set of intersecting spatialities that form a latent but essential aspect of the contemporary process of global urbanization. Operating at local and global scales and reflecting social and environmental processes, this geography of information generates a new set of relationships between people, territories, processes, technical systems, and physical objects. **New Geographies 07** is interested in the imbrications, hybrid forms, recombinant practices, and the murky in-between spaces that attempt to articulate the inherent hybridity of this geography of information.

New Geographies 08–Island Geographies will review the ecological potential of the idea of "island." As a master metaphor, the island has been a fecund source of inspiration in philosophy and science throughout history. From More's Utopia to Darwin's evolutionary theory, the insights derived from "island thinking" are commonly extrapolated across fields and scales. Ecology is no exception: some of its most recurrent tropes (e.g.. niche, patch, footprint, and carrying capacity) relate to notions of limits that the island epitomizes. The appeal of the island metaphor lies in its capacity to frame and simplify the complex and seemingly unbounded. But while the recurrence of the island speaks of its great explicative prowess, it can be argued that the concept is undergoing a crisis. In times of worldwide environmental concern, upscaling ideas derived from "island thinking" to the planetary scale of the Anthropocene constitutes a nontrivial operation. Yet ecology's current privileging of processes and flows over form and objecthood, and globalization's motifs of openness and interconnectedness, seem to challenge the relevance of the island as a cognitive device for territorial description and intervention. **New Geographies 08** will explore the new limits of islandness, while gathering examples that reassert its relevance for the design disciplines.