

INTERVIEW

Climate, Colonial Technoscience, and Architectural History: An Interview with Jiat-Hwee Chang

Anita Bakshi

Architectural historian Jiat-Hwee Chang teaches at the National University of Singapore and studies climatic design and technoscientific knowledge. In this interview, he discusses the themes and places that have influenced his work — from his early experiences as a student of architecture and how they have animated his book *A Genealogy of Tropical Architecture: Colonial Networks, Nature, and Technoscience*, of 2016, to his current manuscript *Everyday Modernism: Architecture and Society in Singapore*, to be published in 2022. In this conversation with Anita Bakshi, Chang reflects on the translation of architectural knowledge into the personal, political, and technical spheres and brings a rich range of knowledge and experience to bear on important current questions of environmental justice, urban inequality, and climate change.

Introduction

Architectural historian Jiat-Hwee Chang studies the transfer and translation of architectural knowledge between various epistemic spheres — between the vernacular and the technical, between colony and empire, and between university and student. The author of *A Genealogy of Tropical Architecture: Colonial Networks, Nature, and Technoscience* (2016), his work draws on such theoretical concepts as Foucault's biopolitical power and Latour's 'immutable mobiles' to understand climatic design and the bodies of technoscientific knowledge that have informed the design of tropical architecture. Trained at a time when postcolonial studies and theories gained importance for architecture, and with a particular focus on Southeast Asia, his work is located at the intersection of the built world, environmental humanities, and science and technology studies.

This interview reflects Chang's many interests as well as the changing field of architectural history. Moving between the influence of personal history on research and the impact of one's training and knowledge on the teaching of history and design, the following conversation shifts between Singapore (where Chang lives and teaches at the National University of Singapore), India, the United States, and the networks of global architectural practice, and navigates an expanding terrain of colonial, postcolonial, settler colonial, and decolonial histories and approaches. As Chang notes in the wide-ranging discussion, these are topics that have until recent years been slow to appear in conversations on architectural history.

Conducted a year into the COVID-19 pandemic, this interview turned often to questions of environmental justice and the inequalities built into urban spaces, as well

as growing concerns about the current and still impending effects of climate change — particularly the future of global climatic design and cooling as not just comfort but a human right in our warming world, which is a subject of Chang's ongoing research. Finally, as architectural firms and schools have begun to question the supposed racial 'neutrality' of architecture, this conversation reflects today's preoccupation with questions of race, identity, and justice in the study and design of urban spaces.

The Interview

Bakshi: You describe how your book *A Genealogy of Tropical Architecture* started off as a project of 'self-inventory', beginning from your travels for studio as a student. Can you explain how that process of returning to your earlier education informed the book?

Chang: I think self-inventory might be a bit too much of a grandiose term that I borrow from Edward Said. What I'm describing is probably not very dissimilar to the experiences of many young scholars, when we are looking for our first project to do. I was trying to find a topic for my PhD and it occurred to me, why don't I go back to a particular formative moment and research it?

I was in architecture school in Singapore from the early to late 1990s, studying under the RIBA (Royal Institute of British Architects) system. It was quite common at that time to have a field trip in the first year — a tradition that stretches back to the founding of the school in 1958. It was the moment of Singapore's decolonization, which at the time was associated with what was commonly known as Malayanization. As you probably know, Singapore was the main colonial port city of British Malaya (today's Singapore and Peninsular Malaysia) — it was a city with a huge hinterland. So part of the Malayanization project at that time was for students to be acquainted with this

broader Malaya, because even though some of them might come from the hinterland, many of them were urban folks and knew very little about the so-called Malayan culture and tradition.

An outcome of the architectural search for the Malayan culture was interestingly the embrace of modern tropical architecture. According to Julius Posener, a German architectural historian who was teaching in Kuala Lumpur in the 1950s, the investigation into Malayan culture was inconclusive in telling the architects then about what a Malayan architecture ought to be. Instead, he suggested that architects in Malaya should not be afraid to build in a new international language, as “the sun of Malaya will forgive us” (Posener, 1957). Tropical nature was seen as a common unifying theme that transcended the ethnic divisions in the multi-ethnic society of Singapore. Hence, even though tropical architecture was a British colonial construct, it was embraced by Malaya-based architects at that time.

By the time I went on the field trip in the 1990s, tropical architecture had mutated into a form of regionalist architecture, associated with Balinese resort architecture, among other things. My first-year tutor then was writing a book on resort architecture in Bali, so he brought us there for the field trip (**Fig. 1**). I was fascinated by these shifting constructs of tropical architecture, so I thought it might be interesting to historicize them.

Bakshi: You’re talking about a particular way of teaching at the time when these studios were taking place and when you were a student – do you teach the same way, or what has changed in how you approach these ideas? Are you teaching design studio classes?

Chang: I just taught design studio last semester ... In my university, the National University of Singapore, it is very common for architectural historians to also teach design studio. With my students – probably because I started off as a historian of colonial architecture – we explore the region’s history of colonial architecture and visit a number of cities in the region, primarily in Indonesia. I still practice similar things to what I experienced as a student, though perhaps I focus more on colonial architecture, as well as vernacular architecture. As a historian teaching studio, I certainly ask students to historicize and contextualize sites and buildings they encounter. I emphasize connecting experience with knowledge and how the broader historical context shapes and influences the ways we understand history and look at certain things.

Bakshi: That’s a great transition to the next set of topics that I wanted to raise, which is about indigenous structures and how we learn from them, as architects, designers, historians, and planners. After reading your book, I was reflecting on how architects have engaged with ‘the vernacular’, from Banister Fletcher’s tree to Hassan Fathy’s notion of the ‘architect as method actor’. How do you engage with that term, ‘vernacular’? What are your suggestions for well-meaning architecture students and historians who try to ‘learn from informality’ and bring it into formal design solutions?

Chang: I’m not sure whether you’ll agree with me on this. My sense is that when we teach architecture history, we view the past in a very critical manner and we ask searching questions. We try to foreground some of the



Figure 1: Awkward bodies: Jiat-Hwee Chang (left) and a studio mate (H. Koon Wee) posing in a pavilion at the garden of a Balinese hotel during his first-year field trip, December 1993. Courtesy of Jiat-Hwee Chang.

complexities and also some of the contradictions of the past. So architectural historians have for a very long time been quite critical about romanticizing the vernacular or 'invented traditions' constructed by elites for specific purposes. There's quite a good body of literature about this. Timothy Mitchell and Panayiota Pyla, for example, talk about Hassan Fathy and the sort of epistemic violence – to use a slightly grandiose term – committed when creating or synthesizing certain forms of tradition as an architect might. Or the literature around Bernard Rudofsky and 'architecture without architects', again idealizing certain forms of vernacular architecture.

As historians, I think we are well aware of the pitfalls of romanticizing tradition. But yet, when we teach design studio, precedent studies are an important part of any pedagogy. Students who are starting out as designers need precedents, and they need also to understand where those precedents came from as well as alternative practices to what we see today.

Bakshi: In your book, you cite Latour on the relationship between the accumulation of knowledge and the accumulation of power, because, as you put it, this accumulation 'allows a point, or a few points, in the network to become center(s) of calculations which can act on distant places because of its familiarity with things, people and events there. Cycles of accumulating knowledge create and reinforce an asymmetry of power between the centers and the peripheries of the network, thus allowing the centers of calculation to dominate others' (Chang 2016: 183). There

has been a lot of recent interest in drawing 'indigenous environmental knowledge' into the design discourse – do you see any of the same dangers of the 'network and power' and the relationship between the 'accumulation of knowledge' and the 'accumulation of power' at play in this?

Chang: When I invoked Latour in that paragraph, I was really referring to colonial scientific networks – who were the agents behind them, and what kind of agency did they have? So I think it's important to ask, what kind of context are we talking about and why is this knowledge being accumulated? In the particular historical moment I was writing about, these specific colonial networks involved colonial agents trying to extend a colonial power relation into the neo-colonial era. That would be an important context for understanding that kind of power dynamic (**Fig. 2**).

In terms of the contemporary situation, as you've hinted at in your question, similar concerns might arise. But the context might be architecture educators who are trying to foreground things that have been marginalized or neglected, reminding us that there are other ways of doing things out there and highlighting an important body of indigenous knowledge about how can we coexist with the planetary forces and the non-human world. When you foreground marginalized knowledge and present it in beautiful ways, there's always the danger of romanticizing it, and there is of course still a power dynamic at work – but it's a different kind of power dynamic.



Figure 2: A researcher placing the model of the Dining Hall, designed by Maxwell Fry and Jane Drew, at University College, Ibadan, Nigeria, on a heliodon to study the effectiveness of the sun-shading. From Foyle (1953).

Bakshi: Yes — understanding what the power dynamics are is an important part of evaluating that kind of work. I'm struck by how those power dynamics can also have to do with geography. You've written about how the research undertaken in the name of 'tropical architecture' privileged 'nature' as opposed to cultural or social influences on building, which led to an emphasis on technoscientific solutions that obfuscated the underlying social and political questions of colonial and postcolonial power relations (Chang 2016: 6). I couldn't help but wonder about how these dynamics might differ in the context of North America or Australia — places where there is not always this clear-cut differentiation between empire and colony but rather (largely unacknowledged) settler colonialism. Do you have any thoughts on what we could take from your research and writing in those contexts?

Chang: I've been thinking about this emerging body of scholarship around decolonizing the different domains of knowledge. I was trained when postcolonial theory was a lot more influential, and when we used the word 'decolonizing', it referred first and foremost to a different historical moment, the moment of decolonization. But one of the overlapping arguments between those two periods of scholarship is that colonialism operates not only through physical violence and military power, but also through what Partha Chatterjee calls 'epistemic conquest' — the construction of knowledge frameworks that let you see the world in a particular way, akin to what Marxist scholars would call cultural hegemony (Chatterjee 2001). As people who deal with texts and history, I think where we can contribute is to make visible this structure of epistemic conquest, and then to challenge the structure of dominance through the counter-knowledge we produce. My sense is that this is the shared objective between postcolonial theory and the current decolonizing scholarship, which may be one way of thinking about your question.

Bakshi: I live in America, though my parents immigrated from India, and we have a lot of family in India. I never studied the architectural history of India, but because of my time there, I got such enjoyment from reading your book because there were so many things that felt familiar from being in Indian cities. Like the punkah wallah who would rotate the early ceiling fan! So I couldn't help but think about the design of New Delhi as I was reading your book.

Writing about the Changi cantonment in Singapore, you use the term 'separation concept', whereby the cantonment was strategically separated by a distance of a few miles from the native city (Chang 2016: 79). This reminds me of Lutyens' design of New Delhi and specifically the spaces separating Old Delhi from New Delhi. This included a green buffer, but also housing types for 'fat whites', 'thin whites', 'fat blacks', and 'thin blacks'. Were any of these dynamics at play in Singapore? Today it is known as a multi-racial and multicultural society, so I am curious if and how city planning or housing design engaged with this?

Chang: There are a few connections. I borrow the term 'separation concept' from Anthony King, who wrote about colonial urban development and was one of the

early scholars to study the urban history of colonial India. His *Colonial Urban Development* was published in 1976 (King 1976). It was Tony who gave me the idea to historicize tropical architecture — not in the narrow way it is sometimes understood as a mid-20th-century invention or the late-20th-century manifestation I experienced as a student, but as a far longer and more fundamental phenomenon of colonization. In his famous 1984 book *The Bungalow*, he has a short section about how tropical architecture is a seemingly neutral term, but one that encompasses so much history — history about how the colonial officials sought to control nature, sought to tame the environment for reasons ranging from public health to forms of segregation (King 1984). One of my advisors at Berkeley, C. Greig Crysler, was a PhD student of Tony's, and Tony became my mentor as well; he is one of the two editors of the *Architext* book series that my monograph was published in. In fact, Tony wanted to write a book about tropical architecture in this broader sense, but decided to move on other projects, so he offered me some notes when I was embarking on my dissertation research. It was extraordinarily generous of him.

What is particularly interesting in Singapore is that the postcolonial government tried to dismantle the control structures that the colonial government established, and tried to do that through housing. In colonial urban Singapore, there were various ethnic quarters — the majority were Chinese, but there were also specific ethnic quarters in which the Malays or the South Asian migrants and their descendants would congregate. Today the tourism industry calls these areas Chinatown, Kampong Glam, and Little India. But when the postcolonial government took over, they redistributed the population in these districts to public housing estates.

As you probably know, there was a major public housing building program in the post-independence era. Around 80% of Singapore's population lives in public housing, and the state established a quota system based on an 'ethnic integration policy' because it didn't want any ethnic group to dominate in a particular neighborhood. In a way, it tried to break down that structure of separation between the different ethnic groups. Within the newly developed towns, they built different religious buildings and public buildings to serve the different communities. So in every public housing new town you will find a modern mosque, a modern church, and then maybe a Chinese and then also a Hindu temple. The state owned a lot of land, which meant that urban planning could be controlled and regulated by state agencies — so this was a move away from that separation concept model toward integration, but an integration that is very much controlled by the state.

Bakshi: Even today, a majority of Singaporeans live in public housing that's owned by the state?

Chang: Yeah, I live in public housing as well. But something like 95% of us who live in public housing own our flats — flats that we bought with state subsidies either directly from the Housing and Development Board or from the open market.

Bakshi: You use Foucault's discussion of biopolitical power to explain the unique colonial situation in Singapore as a mix of biopower and sovereign power — particularly Foucault's analysis of how the state's right to determine life and death 'does not simply mean murder but also every form of indirect murder, for example, of exposing certain people to death or increasing the risk of death for those people'. This includes for you the way the colonial government 'allowed, if not encouraged, a certain segment of the population, specifically the Chinese immigrant laborers, to waste their biological life away and die through opium smoking addiction' (Chang 2016: 84).

And so, of course, I'm thinking about some of my environmental justice work and this differential impact on certain groups. This resonated for me within the notion of different 'sacrificial landscapes', not just in America but also globally, where minority or dispossessed populations are disproportionately impacted by environmental pollution and contamination. I was curious if you had any thoughts about that issue, or other forms of 'indirect murder' in relation to race and space today?

Chang: This idea of biopolitical neglect, where certain populations are 'let die', is something Giorgio Agamben developed further in his own work in the concept of 'bare life'. As I read it, I think he is referring to refugees or people without clear status, without certain kind of rights, lacking the protection or concerns of the state. But there are so many different ways that we can be let die today, many of which stem from more mundane forms of neglect. We see many forms of biopolitical neglect and environmental injustice at work around the world — both in the uneven distribution of environmental risks like polluted air, contaminated water, and all forms of toxicities, and the lack of measures like public health assistance and sanitary infrastructures.

Foucault talked about how that biopolitical power was deeply entangled with the notion of race, and many others have expanded on this (Foucault 2003). In the examples I'm thinking of, race also clearly intersects with class. In colonial society, one could say that the white race, typically, was the one that was socially and economically better off. Today, with the rise of China and Asian economies and the BRIC nations, that equation of race becomes a bit more complicated.

Bakshi: That does speak to a different kind of movement or transfer of this risk — it shifts, and I think your discussion about colonial Singapore gives us room to think through this further as well. I know we've been talking about a lot of heavy topics so far! I was hoping we could talk a bit about design education.

Chang: Let's do that!

Bakshi: You've written about how standards and classifications undergirded the technocracy of the Royal Engineers in their work all across the British Empire. The result of this was a fairly uniform military landscape of cantonments and barracks. Mentioning Peter Scriver's work, you explain that 'colonial technocracy, with its regularized and standardized practices, served not just to control the phys-

ical environment but also to order the cognitive function of the architects and engineers in the bureaucracy' (Scriver 1994; Chang 2016: 77). This statement really struck me as I thought about a very different kind of indoctrination I experienced as a student in architecture school, first at the University of Illinois-Chicago and later at UC-Berkeley. Rather than technical standards, I felt that it was more about 'taste' and what constitutes a 'good design'. It was many years later that I even felt able to question who decides what is good/bad/ugly/tasteful. Garry Stevens' book *The Favored Circle* really helped me to think through this — he argues that 'architectural education is intended to inculcate a certain form of *habitus* and provide a form of generalized embodied cultural capital, a "cultivated" disposition' (Stevens 1998: 187). Stevens points out that the vague and elusive language used in the design studio 'requires students to struggle to wring meaning, to worry about whether they have understood, frantically to hope they will please' (Stevens 1998: 202). I'd like to ask you to reflect on this, and to share your thoughts about the norms of architectural education, and if/how they serve in any way to affect the 'cognitive function' of designers.

Chang: Garry Stevens' book was something that I read when I was in grad school at Berkeley in a course called Design Theory and Methods, taught by Greig Crysler and Jean-Pierre Protzen. We read that together with a few other books that offer a kind of sociology of the profession. Stevens uses a Bourdieuan perspective. We also read Dana Cuff's *Architecture: The Story of Practice*, an earlier book about how architecture education very much was and still is about certain rites and rituals, whereby you gradually join a tribe with its own insider languages and a particular way of doing things (Cuff 1991). We read that together with another sociological book of the profession, Magali Sarfatti Larson's *Behind the Postmodern Facade*.

There are maybe a few parts to thinking about this. One is that every profession develops its own language and its own forms of expertise to legitimize itself as a profession. But as you've pointed out, a lot of this knowledge in architecture hinges on aesthetic notions — it's amorphous and hard to define, and has rightly to be understood as a form of cultural norm or cultural capital as articulated in Pierre Bourdieu's work. It has become a soft form of, in your words, 'indoctrination' in the process of constructing this kind of knowledge and expertise. One could argue that it has also created a barrier in the profession's communication with a larger public, and it has inbuilt bias that might have led us to neglect other equally important if not more important sets of criteria in terms of social relevance, appropriateness, or, to use a term that architects often use, 'user requirements', however one constructs that user.

For me the issue is not so much whether to dismantle this professional knowledge or to get rid of the idea of a body of professional knowledge, but how to broaden it and make it more relevant to the larger social, political issues of the day — like questions of climate change and how we address social inequalities. I think there's a sense of disenchantment with the traditional forms of architectural professional knowledge, but the field is fortunate to have quite a good group of people who are trying to extend that knowledge.

Bakshi: I think there have been positive developments, as you say, in the last few decades. I'm working on a research project with a sociologist at the Society&Design Lab at Rutgers, and it's been fascinating — we meet and talk about design, and having this ongoing conversation with a sociologist has been important in shifting my thinking. I'm hopeful that those types of, I don't know, I guess I'll call them unusual collaborations won't be so unusual in the future.

Chang: Anita, I just want to add that I think these changes are also echoed in the very small subfield of architectural history. The new scholarship on architectural history has likewise expanded between and beyond the traditional historiography of focusing on architects or an internalist discourse of architecture. I think we've seen quite a bit of change in the past two decades, not only with younger scholars but also more established scholars from the previous generation in their attempts to expand the field. If we go to an architectural history conference today, we sense a thriving and diverse field. I think that even a few years ago, architectural historians would not be having this conversation, the one we're having right now, for a journal of architectural history.

Bakshi: Absolutely. Another type of change in some recent decades, which I think your work clearly points to, is how the production of architecture has always been globally influenced and how professional architecture firms have long operated in a global context. You wrote about how the design of barracks in Singapore and in the colonies more broadly encapsulated the tension between the 'abstract standards and norms' coming from the metropole and specificities of local needs and available resources (**Fig. 3**):

The tension here was not so much between the global and the local but between 'universal' abstract simplified knowledge and 'local' practical knowledge or, what James Scott calls, episteme

and metis. The distinction here is between the localized, quotidian, and embodied nature of metis versus the codified, standardized, and technical nature of episteme which is meant to be applicable across diverse territories and heterogenous contexts. (Chang 2016: 57)

Could you speak a bit about if and how you see this distinction in operation today, in the logics of global architectural practice?

Chang: There are obviously quite a few of these big multinational firms around, and in order for them to operate I suspect they would need both sets of knowledge. But I wonder if James Scott was overstating the difference between the two — sometimes we overstate things in order to make a more conceptual point (Scott 1998). I think 'episteme' is really the kind of knowledge that would travel well — when you globalize you always need knowledge that will travel well, best practices or ways designing certain types, otherwise you can't really globalize. So these firms will go around designing building *types*: your office spaces, your stadiums, your hotels, and your spaces of consumption, each of which have aspects that are about global norms and expectations. International travelers have an expectation of what a five-star hotel will be like, say, and multinational corporations have an expectation about what Class A office space will be like.

But I imagine for these firms to be successful in the different localities they do need to be attuned to different forms of local knowledge — building practices, the ways that clients negotiate and commission buildings, unspoken norms. If they are not attuned to this, I doubt they will thrive. One criticism that has been leveled against Scott's work is that even bureaucrats or technocrats, the people who work with codifiable or supposedly universal norms, will require 'metis' to negotiate everyday life, to implement that so-called universal knowledge. I think that it can be conceptually useful to think through these two

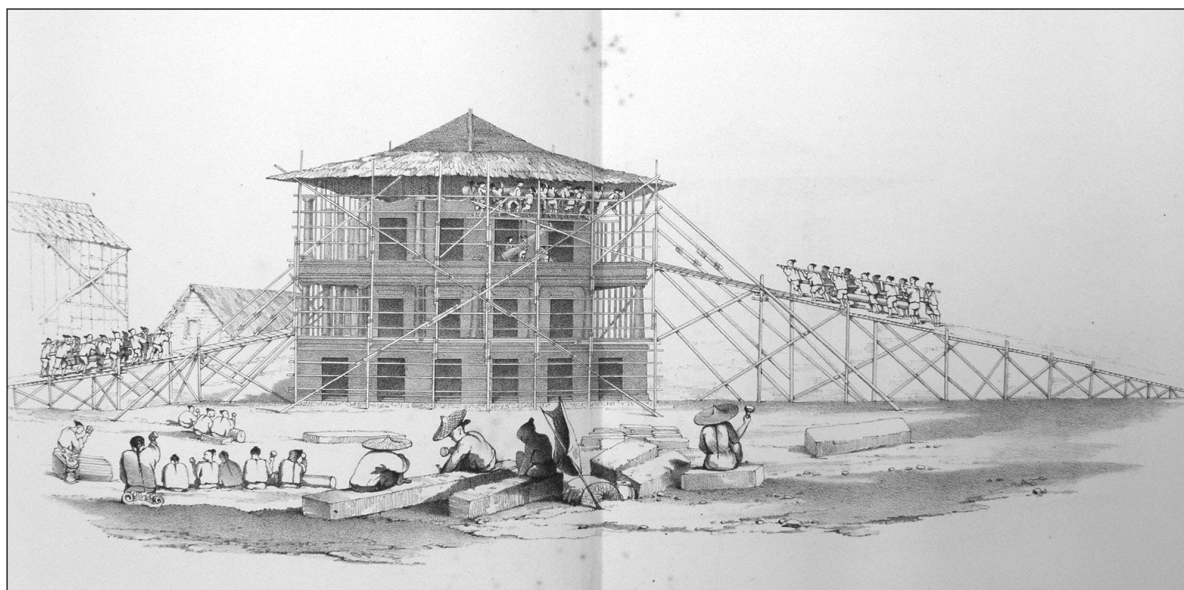


Figure 3: Drawing by Lieutenant Collinson, Royal Engineer, showing Chinese builders constructing a barracks building in Hong Kong, 1856. From Aldrich (1849: 154–155).

categories, but in the messy reality of everyday practices these two intermesh in unpredictable ways. So then the question becomes, in what proportion do they coexist?

Bakshi: Your answer here makes me think a little bit about what you wrote about labor, about the knowledge that artisans and craftsmen brought to the plans that were delivered to them.

Chang: Yes, I think that here the question is more about translation. How do certain forms of episteme or universal knowledge translate to a particular local context? And then how do certain forms of metis or local knowledge translate into international norms? Bruno Latour would argue that there is no universal knowledge, everything is local knowledge – universal knowledge is just local knowledge that translates well because of the forms of infrastructure that allow it to travel well (Latour 1987). He was talking about scientific knowledge, but I'm thinking of the example he used of modern cartography, which enabled the West to map different parts of the world, and to distill and take this local knowledge and turn it into something like an 'immutable mobile', to use his term, that travels well – a point that I think is relevant to our architecture knowledge as well (**Fig. 4**).

Bakshi: Maybe we could turn a bit to the present moment. The sanitary movement emerged in England in the 1830s after cholera outbreaks, and you map out in your book the various ways that this impacted the design of buildings and cities across the colonial network. The resulting design interventions were different for, and thus had different impact on improving the lives of, the empire and the colony. And even within the colony, the settlers and the native populations were designed for in different ways. Your example of the Singapore General Hospital and the number of beds makes this clear: 260 beds were provided for a European population of 9,151, and 538 beds were provided for the native population of 391,311 residents (Chang 2016: 119). I want to ask two questions that stem from this. First, do you have any predictions about what the response might be for city planning following COVID; and second, can we expect similarly differential and inequitable impacts on different populations?

Chang: It's interesting to me, even in the way that we are capturing this conversation, that we are working from home – so COVID is not just affecting traditional medical spaces like hospitals and clinics but the way we self-isolate and social distance from one another, from home. In that sense COVID has broadened the spaces of inequality from the ones you just mentioned into private spaces – right now we are ever more alert to the different kinds of challenges that people face, what environment and technologies are required to connect well. The domestic environment takes on a lot more functions, which has maybe been ongoing, but COVID-19 has made it more visible.

In Singapore, migrant workers generally live in very cramped dormitories. One of the bigger clusters of cases in an earlier wave in Singapore was these migrant workers, and that dynamic didn't just happen in Singapore

but in many societies that have major dependence on migrant workers – Gulf cities like Doha, Abu Dhabi, and Dubai, with their heavy dependence on migrant workers from South Asia and Africa. The geographer Stephen Graham would call this 'secessionary atmosphere', in that the wealthy and the privileged can always secrete themselves in an environment that breaks off from the 'regular' environment, whereas the poor and underprivileged have to bear the brunt of environmental underprovision (Graham 2015).

Bakshi: I think about that a lot – I mean, I'm sitting very comfortably in my study. And I think about how impossible labor and work become when you don't have those right kind of spaces, so thank you for bringing that up. This also connects to your writing on air conditioning and thermal comfort, the problems of 'a thermal comfort standard that could only be met with mechanical cooling' and the resulting 'air-conditioning dependency' (Chang 2016: 251). In the US context, I think about places like Arizona and Florida, and about how widespread this challenge is. Do you see any ways forward in dismantling this dependency? I don't know much about the history of cooling technologies, but is it possible that this is another example of the 'boomerang' that Foucault theorized, whereby mechanisms of control developed to repress the colonized end up being brought back to the West?

Chang: I just reviewed a book on air conditioning in the United States by Joseph Siry (Siry 2021). The compressive refrigeration technology that enabled air conditioning was very much an American invention, but environmental and climatic management has a much longer history and this is where I think the colonies play a very important role – there's definitely an aspect of this boomerang effect. For the US, building the Panama Canal led to the challenge of malaria, which resulted in a number of mosquito-proofing and environmental innovations in the housing of the time. And of course a number of experiments took place in British India – numerous scholars have described the colonies as sites where more things could be done, in contrast to the metropole where maybe they were more constrained legislatively, and in terms of regulation as well.

But for the future of air conditioning – it's a huge and complicated topic and one that I'm interested in, partly because I am in the midst of writing on that history of air conditioning so I'm very interested in what's going on right now (**Figs. 5–7**). There is an NGO called Sustainable Energy for All that created a report called *Chilling Prospects* (2021). They argue that with climate change there will be a growing demand for air conditioning and that it is no longer a luxury but a necessity for the Global South, especially because of climate change – the rise in the mean temperature, starker heat waves, and so on. Recently, the Indian government co-sponsored a competition for a new air conditioner that has five times less climate impact than the current norm, called the Global Cooling Prize. The view shared by NGOs and industry is that if the United Nations is to meet its sustainable development goal of eradicating poverty, then refrigeration and air conditioning is a key part of that.

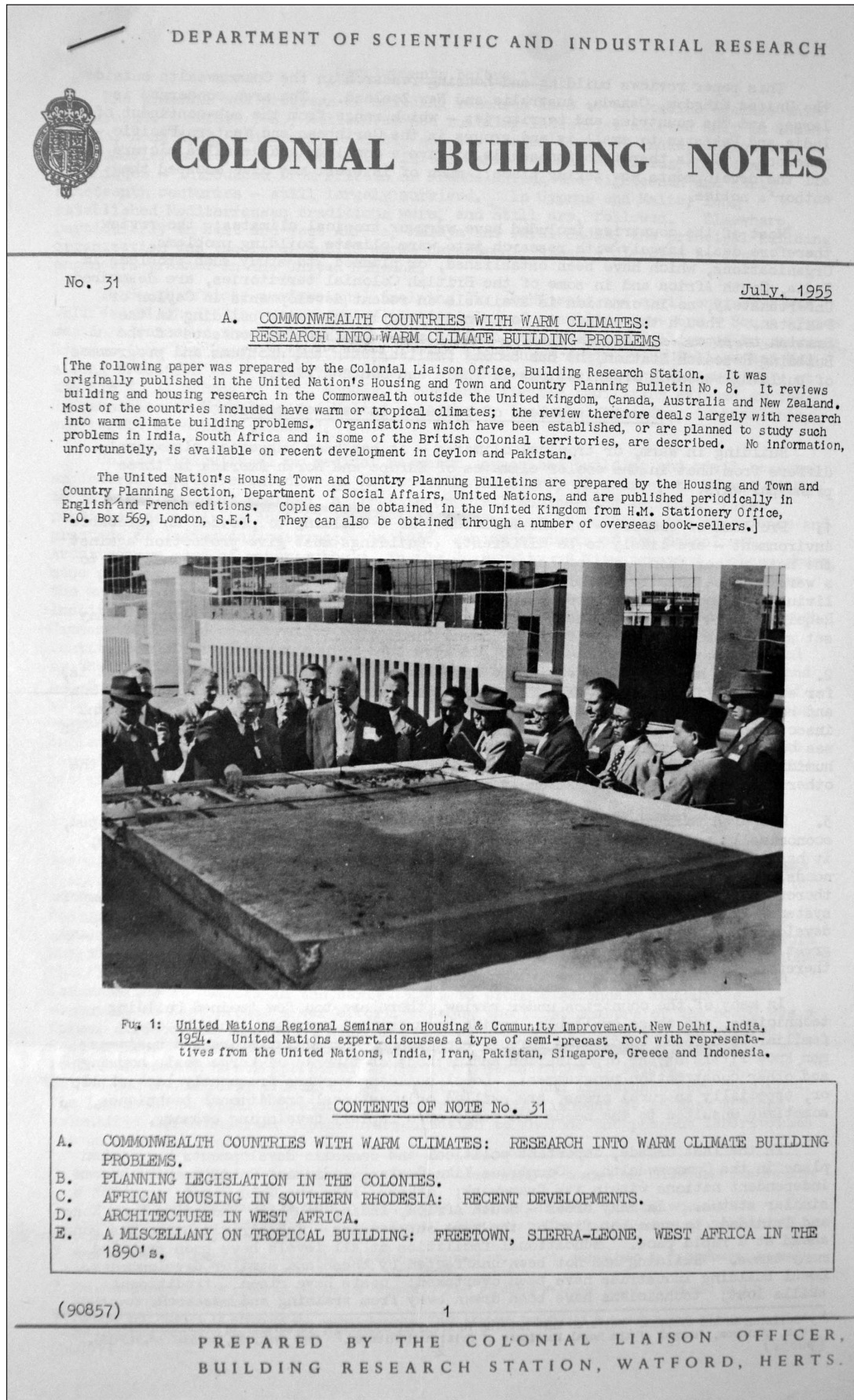


Figure 4: Cover of the July 1955 issue of *Colonial Building Notes*, compiled and edited by the British colonial liaison officer in housing and building, George A. Atkinson. Reproduced with permission from George A. Atkinson.



Figure 5: A model of Msheireb Enrichment Centre, Doha showing the district cooling plant in the middle. Msheireb was masterplanned by Arup and AECOM with Allies and Morrison; design architects include Mossessian Architecture, John McAslan + Partners, Adjaye Associates, Squire & Partners, Gensler, Eric Parry Architects, HOK, and Mangera Yars. Photo by Jiat-Hwee Chang, 2016.



Figure 6: View of old houses fitted with window-unit air conditioners at Al-Asmakh district, Doha. Photo by Jiat-Hwee Chang, 2016.



Figure 7: View of Legorreta + Legorreta's building for the Texas A&M University at Qatar, Education City, Doha, completed 2007. Photo by Jiat-Hwee Chang, 2016.

Bakshi: Do the challenges of climate lead us down a slippery path of 'grouping' places into abstracted and simplified categories that do not take into account their particular conditions? You write about how in the colonial period, 'knowing locality through climate might peculiarly mean that socio-politically diverse entities such as Freetown and Singapore could be conveniently grouped together because they both share the characteristics of hot and humid tropical climate' and even potentially share architectural responses (Chang 2016: 189) (**Fig. 8**). Are we facing a similar categorization of nature into various kinds of climate danger zones, such as 'coastal cities' or 'places at risk of [fill in the climate disaster of choice]', to which universal design solutions might be applied?

Chang: Maybe this is related to our earlier discussion about episteme and metis. For designers and even for policymakers, there's a tendency to take this macro view, to prescribe certain kinds of broadly applicable solutions – which stems from that tendency to map the world, to map zones of vulnerability and deploy different risk management strategies. Many different parts of the world now have heat wave action plans, and the model largely came from North America and then circulated to Europe and to Asia in a kind of policy transfer. And architects have of course responded to those methods of managing environmental risk, as opposed to more localized and grassroots responses. I guess there's always the danger of lapsing into the former. But the challenge, it seems to me, is not to eradicate the former, but to ask ourselves, to what extent can the global, the broadly circulating, accommodate the local and work with local collaborators? That is always easier said than done, since

certain forms of knowledge resist abstraction, resist universalization. I'm not sure whether there can be a better global form of knowledge that is configured so that the local will not be marginalized – that problem seems fundamental to globally circulating knowledge.

Bakshi: My hope is that we'll find ways to engage with local responses, especially communities that have been dealing with these challenges for some years. How are we going to be able to engage their knowledge and how have they been adapting? I hope that the field will develop instruments and mechanisms and methods for that.

Chang: I'm optimistic, because while we are very aware of the prominent examples of global networks of knowledge that disseminate from major agencies and centers, I think there are also new alliances that are being formed between different environmental groups and communities around the world, for example Indigenous environmental groups in Australia and North America coming together to form their own kind of transnational network. With today's technologies and global communications, these alliances might have potent responses to that tendency to be overly abstract and universalizing.

Bakshi: I think you're right that there are a lot of exciting collaborations that are building, and I share your optimism.

On another note, I have never visited Singapore, but I hope to one day, in part because I'm fascinated by the Supertree Grove – I've been awed by photographs of these 'trees' that gather solar energy and vent gases from incinerators that burn waste while also generating

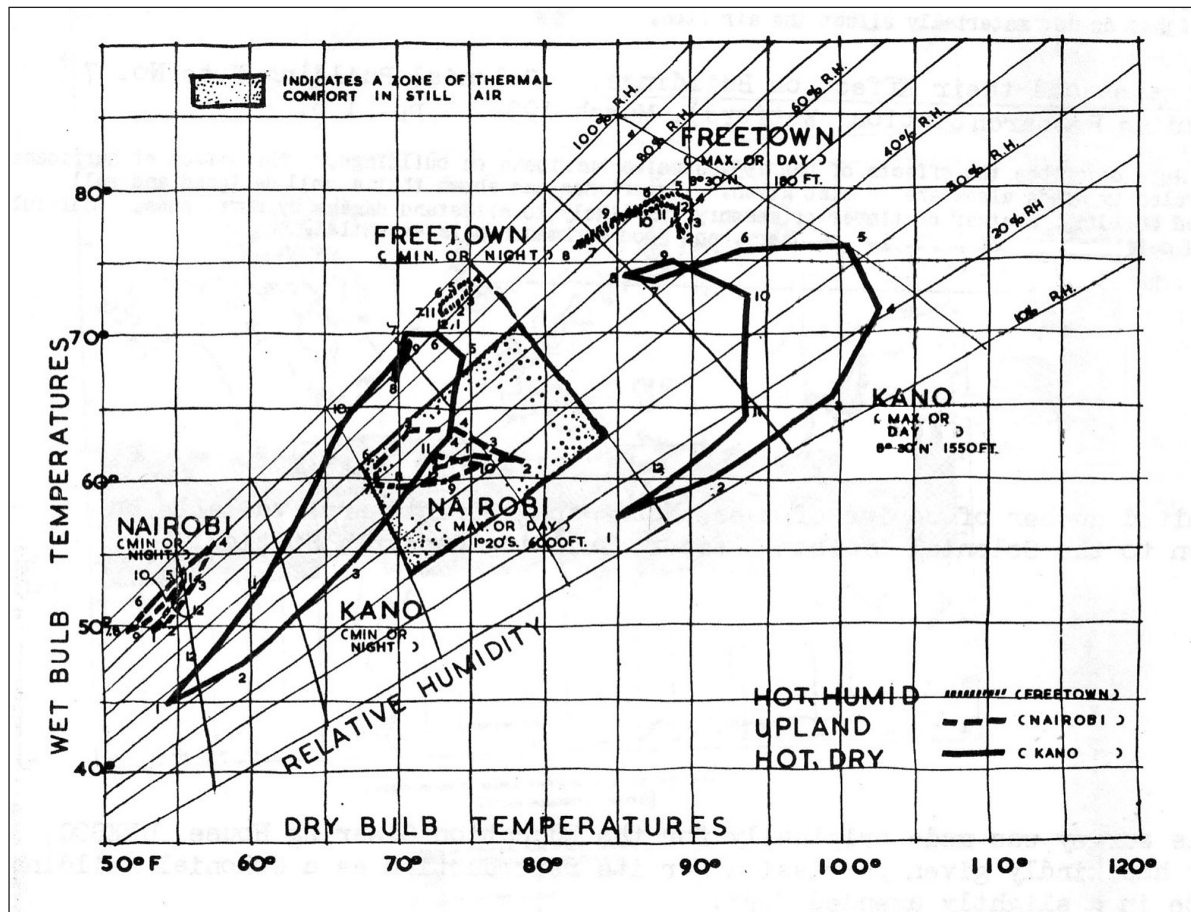


Figure 8: A graph indicating the thermal comfort zone in relation to the climates of the three British colonial cities of Freetown, Kano, and Nairobi, prepared by the colonial liaison officer in housing and building, George A. Atkinson. Reproduced with permission from George A. Atkinson.

electricity. In a chapter titled ‘Edenic Apocalypse’ in the book *Art in the Anthropocene*, Natasha Myers writes that ‘Singapore’s extreme neoliberal vision for unfettered economic growth is barely tamed by discourses of sustainability’, and that ‘where some might hope to amplify the inherent contradiction between economic growth and sustainability, in Singapore this distinction is erased. Here more sustainability means more growth; and this manifests as a kind of growth with unsustainable effects’ (Myers 2015: 32). She goes on to talk about the migrant labor force that the city is being built by, the precarity of existence of these workers and the way that their economic standing prohibits their participation in aspects of the city’s life. I felt some echoes of a few topics covered in your book – technoscientific knowledge, the labor that builds what is designed by others, the relationship between nature and architecture, thermal comfort, and of course climate change. What are your thoughts on the contradictions of ‘green growth’?

Chang: I think what is happening in Singapore today is, as you rightly pointed out, a combination of different things – forms of inequality exacerbated by neoliberal capitalism but also ideas about ecological modernization, ideas that have perhaps been taken from Europe. The idea of ecological modernization is this kind of utopian future in which you can continue to grow the economy while reducing your carbon footprint.

There are political scientists who talk about how as Europe’s economy developed, its carbon intensity reduced. And there’s a lot of investment in a kind of a techno-romanticism about how technological innovation can bring about a greener future. The weird technonature of the Supertree is a manifestation of that – the idea that we can deforest and then replace the tree with a high-performing technological version of a tree. It’s the logic of ecological modernization coupled with a technological imagery borrowed from science fiction. What the proponents of ecological modernization leave out, of course, is how pollution has been outsourced by Europe, how those polluting industries have been consigned to other parts of the world where the environmental regulation is laxer. The long ecological shadow of so-called ecological modernization has not really been adequately talked about until recently.

And in Singapore, there is the even longer shadow of ecological modernization – as you pointed out, it builds from a dependency on migrant laborers and resources from elsewhere. Gardens by the Bay, where the Supertrees are, stands on reclaimed land, made by filling up the sea with sand that some said was smuggled from neighboring countries (Comaroff 2014). Which is all to say that the ‘sustainable’ present of Singapore is constructed on these kinds of exploitation and inequality (Mam 2019) – forms of inequality that, as we briefly mentioned earlier, have been made acutely visible in the COVID pandemic.

Bakshi: The word romanticism came up in the earlier part of our conversation, and you just brought up technoromanticism, which is a new term for me, as well as science fiction. I've found science fiction or climate fiction or cli-fi to be an interesting way to contemplate what the future might bring, the different possibilities, whether horrific or uplifting. I'm glad you brought that up, because one is reluctant to bring up science fiction in a serious academic meeting of architectural historians! But I'm convinced that there's some kind of role for fictive projection when we imagine what the future will bring.

Chang: Sometimes it's pretty apocalyptic out there, so we imagine future scenarios that are really awful. But of course, if you read about sustainability or climate change resilience adaptation and mitigation today ... there's quite a bit of science fiction in that (Schneider-Mayerson 2017).

The Gardens by the Bay project really embodies so many contradictions. I'm not sure whether you're aware that besides the Supertrees there are these air-conditioned greenhouses that tried to capture and represent two types of climate, the Mediterranean climate and a subtropical highland, which is a cooler and more humid environment. And in the conservatory that has the highland climate, you go up this ramp and then descend down into the middle of this building that doesn't really look like a building, and there are all these messages about sustainability (Fig. 9). You're in this space that is air-conditioned, that

is cool, and you can only imagine the energy intensity of that. The irony of having this message of climate change and responsibility coming at you is so weird.

Bakshi: I feel like this brings us nicely to the final sentences of your book:

But we are now at an important historical juncture, when the advent of the Anthropocene epoch means that we no longer have recourse to nature. Without recourse to nature, tropical architecture of the future will have to wrestle with the issues connected to tropicality, technoscience, and governmentality laid out in this genealogy. (Chang 2016: 252)

Since the publication of the book in 2016, how has your recent scholarship and teaching engaged with climate change and design?

Chang: I briefly mentioned earlier that I'm currently working on what could maybe be called 'post-tropical architecture'. If tropical architecture is about passive means of responding to the environment, generally through natural ventilation and shading, the current project is really talking about mechanical cooling and active strategies of dealing the climate. I've been looking at the history of air conditioning, primarily at sites in Singapore but also in Doha and other Gulf Cooperation Council Cities – cit-



Figure 9: Interior view of the greenhouse with a subtropical climate at the conservatory of the Gardens by the Sea, Singapore. This climate is created by the cooling effect of what is called the Cloud Forest. Photo by Jiati-Hwee Chang.

ies that are entirely dependent on, or one might even say addicted to, air conditioning.

Another trajectory is to continue to work on the local and on the regional. I think that has always been an obligation of a scholar based in a small place like Singapore. I've just completed the manuscript for a book called *Everyday Modernism*, which documents the vernacular modernist architecture of Singapore (Chang, Zhuang, and Soh 2022). This came about in part because I've been involved in some attempts to call for the conservation of a number of modernist structures built in the 1960s and 1970s (Fig. 10). According to traditional criteria, these structures haven't got that much architectural merit, but they do have lots of social relevance, and thinking about conserving them is also a move away from Singapore's dependency on the current tabula rasa model of development, which is to demolish buildings and then to build new ones. Always demolish and rebuild. So I'm part of a group that is interested in thinking about how maybe we can move into the future by retrofitting existing buildings by addition, and by living with this huge amount of building stock that Singapore has constructed post-independence.

Bakshi: I wanted to close by asking a question about how we put personal positionality in relationship to knowledge creation. How might we follow Stuart Hall's call to 'forge something new' from our inherited knowledge? He writes about how there is no 'going back' to a former place or a former condition because it no longer exists (Hall 1991). How do you engage with this in terms of bringing traditional knowledges in play to address the current

climate crisis, without resorting to one-size-fits-all solutions? It seems like you have been living and negotiating and working between different registers. I'd love to hear your thoughts on how you navigate this.

Chang: Anita, that's a great question and a wonderful way to wrap up the conversation. I agree with Hall's general point that we should not be craving a return to any kind of origins, because those origins are in a different place and have a different history, and we are now on a different kind of trajectory. James Clifford talks about our obsession with roots, in terms of where we come from, and says that perhaps we should turn our attention to *routes*, in terms of the pathways and trajectories that we have taken, rather than to points of origin.

Like you, I'm a descendant of immigrants – I'm a third-generation Singaporean. It's incredibly difficult to talk about what constitutes the tradition that I could return to, even if I want to return to it. As a third-generation migrant in a multicultural, multiethnic society, I think I am like many other Singaporeans in being constituted by multiple origins and multiple routes. So I appreciate your invocation of Stuart Hall, as a reminder that often we dwell between, travel between, work between various cultural worlds and historical trajectories.

I think that for a history of technoscience especially, it is incredibly useful to think about such forms of hybridity – not just one that is dependent on technological solutions, but how the technological can work with the social and cultural to come up with alternative forms of future.



Figure 10: The Golden Mile Complex, one of the many modernist buildings that form the background to everyday lives in Singapore, completed in 1973. Courtesy of Darren Soh, March 2018.

Bakshi: Thank you so much, Jiat-Hwee – that feels like a nice place to end the conversation because it leaves the question open and keeps so many things in play for us to think about.

Competing Interests

The authors have no competing interests to declare.

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