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Recycled Buildings: Challenging Sustainability in an Era of Air Conditioning[1]

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Abstract

It is now often said that the greenest building is one that is already built. But as we approach the question of re-using buildings very different issues and challenges come up when compared to other discussions about recycling. In contrast to the recycling of consumer goods, the built environment involves questions of planning, urban development, legislation and an unclear disaggregation of who are the customers, producers and end users. As such then there are very different ideas of responsibility involved. The majority of recycling debates typically focus on the present or recent past, but in buildings we are faced with the ideas, visions, politics and failures of previous years, decades or centuries. To ask the question about recycling buildings is thus a consideration of the possibilities and limitations of recycling the past, in all its material, concrete, earthy and immovable forms.

As we will see, the recycling of buildings is increasingly featured in discussions about sustainability and the reduction of energy consumption, with the re-use of existing structures having very real benefits over newly constructed 'eco' or 'green' architecture. This is particularly applicable in the face of an epidemic of architectural design now spreading across regions like Southeast Asia, that of electronic air conditioning (AC). In the pages that follow, the emergence of electronic air conditioning is seen as a pivotal transition in urban design and living, such that two phases of modernity are identified: the *pre-conditional* and *conditional*. Across Asia there is an extensive stock of buildings designed and built in a pre-conditional era, which kept occupants – human and non-human – cool and comfortable in the heat and humidity, without requiring energy intensive forms of electronic air conditioning. This paper considers the degree to which Asia's 'modern' pre-conditional architecture constructed over the last 100 years or so can be recycled and re-used without modification for AC today, in the quest for a more sustainable, less energy dependent built environment. To head in such directions, it will be argued we need to move beyond current debates about tropical architecture design, adaptive re-use and urban planning and engage with a series of wider political, cultural and socio-technical forces. Given the limited space here, the paper presents this position by focusing specifically on some of the ways in which 'the material imagination of air' has shifted over the last 150 years or so and how this bears upon the future of sustainable urbanism in regions like Southeast Asia. The argument advanced is that under the conditions of modernity, the materiality of air, and the material imagination of air, has altered dramatically.

Keywords: Air conditioning, sustainability, Southeast Asia, architecture, material imagination of air

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An uncomfortable truth

Any claims and ambitions for more sustainable futures in Asia are severely compromised by the widespread and rapid take up of energy intensive methods for cooling interior spaces. Over the coming two decades Asia will be the main driver of a 40 per cent increase in global energy consumption, more than three quarters of which will continue to come from fossil fuels (Fernando et al., 2008). As elsewhere in the world, for the majority of Asia's countries the built environment, through its construction, operation, deconstruction and demolition, accounts for more than 50 per cent of all national greenhouse gas emissions (Carroon, 2010). Given that around half of that energy consumption is typically associated with the cooling or heating of interior spaces, in the case of tropical Asia – much of which experiences extended periods of hot and humid weather – carbon emissions have increased dramatically in recent decades through the introduction of electronic air conditioning (Li and Yao, 2009). Where once air conditioning was regarded as a luxury, in a few short decades it has become a near ubiquitous technology for regulating the temperature and humidity levels of interior spaces throughout the region's tropical and sub-tropical zones. With this trend set to continue, in Southeast Asia the mechanical cooling (and drying) of the built environment will be a significant factor contributing to a demand in energy that is outpacing much of the world, increasing from current levels by around 75 per cent by 2030 (International Energy Agency 2009).

Examining the rapid adoption of air-conditioning technologies in India, China and Indonesia, Wilhite (2009: 87) notes 'changes that took place over many decades in the US and Japan are happening at a rapid tempo'. If we carry these trajectories forward, their significance becomes starkly apparent in places like China where it is expected more than 70 per cent of the population will live in cities by 2050. Asia's rapid economic growth meant that 111 of the world's 140 new large or big cities emerging after 1990 were in the region; its population will grow by 1.25 billion by 2025, more than half of which will live in cities (United Nations Human Settlements Programme, 2008). As megacities continue to spring up across different parts of the planet, the vast majority of growth will occur in the developing world, with Asia once again dominating the statistics. Once we situate the recent region-wide adoption of air conditioning in these wider social contexts and trajectories, it is clear that an alternative, less energy intensive, climate control paradigm is urgently needed, one that will contribute to more sustainable urban futures and forms of socio-economic development. As Wolfgang Lauber et al. (2005: 198) state in their contemplations on the future of architecture for tropical regions:

> This increase in urban density today means that in many parts of the world ecological issues are being ignored or abandoned. The intensive use of building sites, the stacking of living and work spaces and the increased density of traffic leads to urban spaces and building structures that are based on American models from the 1940s and '50s, which require an energy intensive use of technology and disregard the level of energy consumption and its effect on the environment. The invention of air-conditioning has ensured that large buildings and high-rises can be supplied with fresh air as well as sufficient cooling and heating energy. From an environmental viewpoint, the use of 300-400KWh/sqm per year to provide this technically produced comfort is simply too high.

Discourses of sustainability

Responses to this 'epidemic' of energy intensive cooling have varied, and in that regard directly reflect some of the discordancy in perspectives that currently shape debates in Asia's built environment and urban sustainability. In the last ten years or so the discourse of 'green' building has gathered momentum and expanded in scope. *Efficient* and *alternative* have been the two guiding mantras of reducing the carbon foot-print of construction. Within this, much attention has been given to the question of energy production and saving (Russek and Zimm, 2006). The *component*-based approach to this, largely advanced through the professions of building sciences and mechanical engineering, has focused on the constituent parts of building infrastructure such as water treatment systems; Heating, Ventilation and Air Conditioning (HVAC) systems; and so forth (Atthajariyakul and Lertsatittanakorn, 2008; Hwang et al., 2009; Mui, 2006; Mui and Wong, 2007). In the case of air conditioning a highly technical field of expertise has emerged, advancing highly scientific, physiological standards of built environment comfort (Hindrichs and Daniels, 2007; Yik, Burnett and Prescott, 2001). This has led to prescriptive proclamations about 'optimum' temperature and humidity ranges for indoor spaces (Lam, 2000; Tuohy et al., 2010). And while much attention has been given to making HVAC technologies more efficient in using existing grid-based power supplies, the search for alternative cleaner, greener energy has primarily been advanced in tropical and sub-tropical Asia via solar panel technology. In the case of both domestic and commercial architecture, this has typically involved introducing in-situ installations, whereby grid-supply electricity is supplemented, or in some cases even replaced. Equally important have been recent advances in the area of material technologies, with glazing, concrete, foam and plastics all being branded as 'high-tech', 'thermally responsive' or even 'intelligent'. Mathematical modelling in this area has grown in its level of sophistication, but it is a paradigm of human comfort analysis that has been critiqued heavily for inadequately acknowledging a host of social, geographic and micro-contextual variables. Authors like de Dear (2006; see also Brager and de Dear, 2007) and Healy (2008) have spearheaded a critique of what they observe as the new regime of 'thermal monotony', that has spread rapidly across building types and between countries with very different climatic conditions.

Alongside, and often operating in tandem with this component-based approach has been the field of 'eco' or 'green' architecture, which has attempted to forge a more holistic conceptualisation of design and construction for environmentally responsible and responsive buildings. The rallying cry of sustainability has given new impetus to the vocabulary of 'tropical architecture', whereby climate sensitive materials and designs inherited from the past are combined with new ideas and construction technologies to create structures that require less energy in their provision of occupant comfort. In their 2006 volume *Tropical Sustainable Architecture*, Bay and Ong identified both the importance and challenge of creating a culture of architectural design appropriate for high-rise, high density tropical urban spaces:

> While the air-conditioned high-rise is easily replicated in the tropical city, the effects of urban canyons and heat entrapment in the city are different for the tropics. While sunlight is welcome in the temperate city and buildings are set back to allow sunlight to penetrate to the road level, shade is preferred in the tropics. While snow and sleet may be a problem in temperate cities, the problem in the tropics is heavy rain and flooding. While strong gales are better avoided in colder cities, more wind and ventilation are welcome in the tropical (and sub-tropical) city. It is only recently that urban studies

> have been made to some depth in tropical cities and the findings are suggestive in terms of the design of the tropical city for the future (2006: 8).

In the context of Southeast Asia, the 'eco-skyscraper' has given this language of tropical architecture its most spectacular and grandiose form. Architects like Ken Yeang are among the pioneers in this field, whose 'bio-climatic' high-rise designs seek to offer a solution to an inescapable future of densely populated urban spaces. A philosophy of ecological design is made manifest through a mix of natural ventilation of spaces; sun-shading; wind-scoops; vertical landscaping; natural lighting systems; and building orientation and material (re)usage considerations (Yeang, 1994, 2007, 2009). The National Library in Singapore is among the examples that exemplify this approach.

Another strand of sustainability that can be identified here is one oriented by the philosophy of conservation, and the maintenance and re-use of the existing building stock. The US-based architect Carl Elefante is widely given credit for the aphorism 'the greenest building is…one that is already built' (2007: 26). What he and other preservation-oriented architects point to is the need for proper life cycle assessment (LCA) models which more realistically consider the 'cradle to grave' energy properties of the built environment. Indeed, in her notable volume, *Sustainable Preservation: Greening Existing Buildings*, Jean Carroon (2010) highlights the importance of calculating the 'embodied energy' of a building in relation to its lifespan. This notion of embodied energy seeks to capture the environmental debt incurred from the resource depletion and energy used in construction (ibid.: 7). As the service life of a structure increases, the ratio of embodied to operating energy decreases proportionately. Whilst Carroon and others now position their arguments relative to the current discourse of 'green' or 'eco-' architecture, they stand on a literature of empirical studies that demonstrate the benefits of preservation over demolition and reconstruction (Balderstone, 2004). Early research conducted by organisations like the Advisory Council on Historic Preservation in the USA in 1979 through to more recent United Nations Development Programme studies point unequivocally to the significant economic and energy savings that can be made from recycling and re-using buildings. As Elefante puts it:

> Seeking salvation through green building fails to account for the overwhelming vastness of the existing building stock. The accumulated building stock is the elephant in the room: Ignoring it, we risk being trampled by it. We cannot build our way to sustainability; we must conserve our way to it (2007: 27).

To date the majority of these studies have been conducted in Western developed countries like Australia, France, Germany, UK or the United States. Given the accelerated speed of construction, destruction and redevelopment in regions like Southeast Asia – such that buildings often have significantly shorter lifespans than they do in the urban economies of North America or Europe – locally conducted studies demonstrating the environmental merits of building conservation or recycling would offer an important contribution to the conceptualisation of urban sustainability. The questions about energy intensive electronic cooling methods raised here mean the potential benefits of extending the lifespan of the existing building stock extend far beyond a reduction in the 'embodied energy', to include sizeable reductions in their 'operating energy' too. In tropical and semi-tropical Asia extending the lifespan of buildings that continue to live and breathe without mechanical air conditioning promises sizeable energy reductions. More specifically, recycling buildings that lie outside the current AC paradigm have the potential for making an important contribution to countering or mitigating the prevailing trends towards increased energy consumption cited earlier.

In order to achieve such goals, however, this paper argues that the questions and challenges involved in recycling more energy efficient buildings extends far beyond themes of architectural preservation, or urban planning and legislation. While the value and urgency of the different approaches outlined above is readily accepted, my argument here is that, in themselves, they are not enough. To date, responses to the challenges of built environment sustainability vis à vis energy in Southeast Asia have largely focused on issues of design, technology and the materiality of construction. What is all too often absent here is an appreciation of the wider social, political and cultural contexts within which buildings have evolved, and the ways in which that emplacement has shifted over time. A tempting critique to offer here, and one that would be valid, is the need for paying greater attention to questions of 'social context' – for example, political, legislative, governmental and market factors – which might prevail or have influence at any given moment in time. The insights provided by those working in the analytical space of Science and Technology Studies (STS), for example, would be extremely pertinent for interpreting such themes. Instead, however, I wish to pursue a somewhat different analytical path by considering how certain socio-cultural shifts come to bear upon, and in so doing reshape, the built environment over time, in the making of history. The propensity of the *longue durée* to render change invisible is well understood, but in this context imperceptibility is reinforced by the very immateriality, the ethereality of that which has now become unsustainable: cool, dry air. The aim here is to give focus to this immaterial, and to that which very often remains invisible, unseen, and as such beyond the realm of critical discussion and scrutiny.

Accordingly, the aim is to reveal some important hidden histories, tracing what Gaston Bachelard (1988) and Steven Connor (2010) have both referred to as 'the material imagination of air', and its various pathways of evolution over the last 150 years or so in Southeast Asia. In his recent volume, *The Matter of Air*, Connor argues the material-centrism of philosophy and science has been matched by an equal unease and discomfort with the seemingly unpredictable and unreliable immaterial. His work seeks to both expose and address this imbalance through a focus on air and its relation with the material world. Such themes are directly relevant here and I seek to extend his analytical frame into the domain of air conditioning, a theme he surprisingly passes over.

Pre-conditional modernity

To render the invisible more visible it is helpful to differentiate between two distinct, albeit overlapping, phases of a modernity in Asia: the *pre-conditional* and *conditional*. In their conceptualisation and historical dating, modernity, modernism and the even more circumspect notion of the 'modern world' are inherently contentious and evasive terms. Different fields of scholarship have considered a wide variety of historical trends, ruptures and turns – in manufacturing, architecture, literature, art, technology, religion or philosophy – in order to proclaim the arrival (and subsequent death) of modernity and the modern. In broad terms, the Enlightenment and Reformation, together with events of epochal importance like the French Revolution, are now widely recognised as key factors in the shaping of a 'modern' European era. More recently, however, a vibrant debate has emerged concerning the Eurocentric historiography of modernity and the degree to which non-Western modernities can be adequately understood within Euro-American analytical frames (Gaonkar, 2001; Alatas, 2001). Walter Mignolo (2003), Partha Chatterjee (1993), Dipesh Chakrabarty (2000) and Timothy Mitchell (2000) are among those who have convincingly argued the

historiography of modernity suffers from profound Eurocentric biases. Mitchell distances himself from those advocating a history of 'alternative modernities' (Gaonkar, 2001), suggesting instead that we attend to the incomplete universalisms and singularities of modernity's project in different regions of the world under specific historical conditions (Mitchell, 2000: xii-iii). Chris Bayly (2004) has also drawn on Hobsbawm's (2002) notion of the 'age of revolutions' to argue Europe was not alone in experiencing a series of profound cultural, political or technological shifts. Accordingly, he describes the period of 1780–1820 as a time of 'converging revolutions', whereby the after-shocks of events in Europe could be felt in Asia, North Africa and the Americas, and, crucially, 'the repercussions of these extra-European conflicts fed back into the European convulsions' (ibid.: 86).

A detailed exploration of modernity in Asia is beyond the scope of this discussion. It does however form an important backdrop to the emergence of a 'modern' built environment and architectural form in the region. Greater attention is now being paid to the complex processes which enabled the development of modernism and modern modes of construction and design ideas in Asia. A more detailed picture is now emerging of how the modern is constituted in different ways in different places and over different timespans. The arrival of new technologies, shifts in political systems, economic transitions, freak encounters, the incorporation of new ideas and so forth all mean the history of a modern idiom for the built environment – and what might be identified as modernism – is chaotic, haphazard and largely incoherent. Nonetheless, some key patterns and milestones provide greater clarity to the story of particular countries and regions. Cody (Cody, 2001; Cody, 2003; Cody, Steinhardt and Atkin, 2010) and Denison and Ren (2008) are among those that trace key transformations in the built environment and the arrival of modernism in China from the mid to late nineteenth century onwards. Each approach modernism and modernity with a distinct sense of caution, with the latter stating:

> The term "Modernism" is vague and often hides a multitude of semantic sins…to write a book on the Modern Movement in China would result in a very meagre read, as no such singular movement existed. Instead, it is a story of an intriguing range of different movements and influences appearing on China's soil from all corners of the globe (Denison and Ren, 2008: 9).

Together such external movements and influences would have a catalytic effect on Chinese society, creating a series of political, social and intellectual shifts that would bear upon architecture and the planning of cities. Throughout much of China traditional forms of construction relied heavily on wood. Although masonry and brick were used extensively, they were primarily used for walls, bridges, ceremonial sites and monumental structures. Tradition-based architecture was, in the main, designed around load-bearing wooden columns and beams. Interior spaces were created by linking together units (*jian*) of four columns with interlocking horizontal beams. As Denison and Ren state, 'timber was abundant, cheap, easy to work, flexible, strong, pleasing to the eye, and tactile. The one thing it lacked was permanence' (2008: 19). The authors suggest however that as the nineteenth century progressed, the construction and design of buildings began to alter in significant ways. Engineers would lead the way through the incorporation of metal, concrete and glass. Ideas would arrive from Europe and, as Cody (2003) highlights in substantive detail, from the United States. China's treaty ports would undergo the greatest changes, as engineers, both foreign and domestic, set about building roads, railways, bridges and power stations, and transforming their urban centres with cement.[2] In the closing decades of the nineteenth

[2] See Denison and Ren (2008: 47) for further details.

century the United States would become one of the world's key exporters of construction knowledge and materials. World's Fairs hosted in Chicago, San Francisco and Philadelphia provided showcases for 'American architecture, urbanism and technology as exemplars of modernity' (Cody, 2003: 8), from which newspaper journalists from all over the world would report. At the beginning of the twentieth century the American skyscraper 'invaded' countries across Europe, Central America, Africa and East Asia. It was a form of construction that came to increasingly rely upon the marriage of steel and concrete. At first steel skeletons would be clad with concrete walls. Subsequently though the idea of steel 'reinforced' concrete delivered significant advances in strength and load-bearing capacity.

The industrialisation of Europe and the United States provided an important base for modern architecture in many parts of the world. Much like elsewhere, the first architects in China came from engineering backgrounds. But equally important was the boom in factory construction, the development of large-scale, industrial designs, and the mass production of the technologies and materials required to build them. China was long familiar with the importance of iron in construction, but only transitioned to the production of steel in the mid to late nineteenth century. The country's first cement factory was established in 1882 in the town of Qinzhou, near Macau, with others following shortly afterwards (Denison and Ren, 2008: 59). The arrival of foreign architects and engineers would greatly accelerate the speed and scale of industrialised urbanism, a landscape characterised by multi-storied reinforced concrete and great expanses of glass. Shanghai's first office building constructed entirely from reinforced concrete was completed in 1908. The Shanghai Mutual Telephone Company Ltd would rise six stories, but the take up of steel frame, reinforced concrete designs in the years thereafter would lead to skylines of taller, lighter and evermore efficient buildings across a number of Chinese cities (ibid.: 64).[3]

If we turn to India, a similar pattern of foreign engineers and architects importing new ideas and technologies is evident. British rule played a definitive role in defining the styles, designs and construction methods which together constituted modernism in cities like Delhi, Calcutta and Bombay. The formation of an Anglo-Indian architecture was most monumentally realised in Edwin Lutyen's designs for New Delhi. Characterised by their neoclassicist style, parliament buildings and government offices for the new capital incorporated various features from traditional Indian architecture. Although built on an altogether different scale, the colonial bungalow offered another example of the Anglo-Indian style of architecture that emerged under the British. As Anthony King (1984) highlighted, the constant reinvention and reproduction of the bungalow in different contexts meant it became one of the most recognisable examples of what latterly came to be known as 'tropical architecture'. Accordingly, Margaret Purser (2003: 295) notes:

> From these early roots, the bungalow as colonial administrative form moved out to encircle the globe, and by the mid-nineteenth century was an instantly recognisable imprint of British imperial presence. Its evolution continued to exhibit the simultaneous expression of British cultural identity, and of a rapidly expanding body of adaptive knowledge about how to build and live in structures in tropical climates….The buildings were raised on posts to avoid insects, disease, and rot; rooflines were modified to alleviate the oppressive heat of the metal roofs; ceilings rose, and interior rooms themselves became larger.

[3] See also Cody (2003), Chapters 1 and 2, for further details.

European architects had to learn how to build and design for the cultural and climatic conditions of tropical and sub-tropical Asia. Indeed, considerable scholarship has been dedicated to the 'evolution' of the 'tropical architecture' typology, one that came to be increasingly oriented around verandahs, overhanging rooflines, perforated screens, as well as an accumulated knowledge of the need to design in accordance with orientation, shade, cooling breezes and water (Coles and Jackson, 2006; Fathy, 1986; Ford et al., 1998; Fry and Drew, 1964). More recently, however, by attending to the connections between politics, governmentality and technological advances that existed across great distances, authors like Jiat-Hwee Chang (2007, 2011) have offered new insights for interpreting this form of colonial and tropical architecture as an unfolding 'situated knowledge'. Chang argues an international power-knowledge network of design came into being, one that relied upon a particular notion of place which was abstracted as 'far' away from temperate, civilised Europe and principally known in terms of climate and the challenges of thermal comfort. Although Chang's focus is the socio-technical pathways of British tropical building, his arguments are equally pertinent for understanding the histories of French and Dutch construction in countries like Cambodia, Laos, India, Indonesia and Vietnam.

At the beginning of the twentieth century in India this vocabulary for building in the tropics was infused with the design motifs of Art Deco. Houses, apartment buildings and civic structures all included flat roofs, cylindrical external staircases, curved verandahs, pastel colours and various decorative motifs familiar to the Art Deco movement elsewhere. But as Lang (2002) points out, experimentation and the importation of new design themes and ideas were not merely dependent upon foreign architects and engineers. Between the two world wars cities like Mumbai and Delhi were being transformed by avant-garde Indian designers, who playfully incorporated decorative motifs popular in the United States and Europe. Interestingly, by the 1930s Art Deco increasingly expressed a sense of Indian modernism, through the incorporation of local cultural themes and traditional design elements. As Lang (2002: 17) explains:

> The integration of local elements and Art Deco motifs displayed in the Indo-Deco is more complex than in many other countries because of the diversity of India's architectural background. The elements borrowed from traditional house forms included sloping overhangs, corbelling and cement jaalis. Not only were Hindu and Islamic elements used but also elements of the country's colonial heritage. Patterns in Art Deco murals varied from abstract swastika patterns to representations of Indian legends and myths.

For the country's more strident nationalists, however, it was an architectural trajectory that represented yet another form of cultural imperialism. According to Lang, an important response was the 'Modern Indian Architecture Movement', which took hold across a number of regions and cities. Tradition and past architectural styles were explicitly referenced in the creation of a new, present Indianness, such that the modern built landscapes of cities would be the source of pride and identity (ibid.: 25). In cities like Hyderabad, the symbolism of tradition drew heavily from an Islamic architectural heritage. However, under the guidance of the architect Sris Chandra Chatterjee, the 'Modern Indian Architecture Movement' was clearly Hindu, influenced heavily by the principles of the Swadeshi movement of the early twentieth century and the canonical texts it referenced. The language of revivalism and 'Indian principles' did not however negate the incorporation of new construction ideas and technologies. Chatterjee extensively used modern materials such as concrete in his buildings. Nonetheless, his ideas steadily came to be seen as retrogressive and out of step with the directions of mainstream modernism, and, crucially, the political ambitions of figures like

Nehru, who in the 1950s gave his support to a radically different form of architecture, that of the steel, glass and reinforced concrete of Le Corbusier.

Indeed, during those mid-century years of independence across South and Southeast Asia architecture and urban planning were the vanguards of ambitious claims of national sovereignty and progress. In Cambodia for example, from 1953 onwards Norodom Sihanouk channelled his vision of a modern, independent nation into a particular style of urbanism, coined 'New Khmer Architecture' (Grant Ross and Collins, 2006). Conceived at a time when air conditioning was prohibitively expensive to install and run, this predominantly public and commercial architecture was designed to facilitate airflow and natural cooling to counteract the tropical heat. The chief architect of this movement, Vann Molyvann, undertook carefully planned, well-considered research, referencing the various Cambodian urban centres of the past 2,000 years (Vann, 2003). The heritage of these long-lasting, structured societies was one of the reference points for the development of a style of architecture and planning that would form the physical environment for new urban centres intended to be of comparable greatness. Cooling features such as the iconic, fanned concrete roof tops, and double-brick walls shielded Vann Molyvann's buildings from the tropical heat. Many buildings were raised on stilts, consistent with Cambodia's pre-modern vernacular architecture. Windows were positioned in order to avoid the path of the sun. The use of stilts also demonstrated his regard for the practical heritage of cooling found in the Cambodian vernacular. These implementations of local knowledge were combined with innovations enabled by modern scientific research; techniques gained by Vann Molyvann, along with a modern aesthetic, while studying under Le Corbusier in Paris.

Lai traces a similar story for post-independence Malaysia, where a nascent national architecture was energised by architects and engineers returning home from training and employment overseas. Lai (2005, 2007) sees concrete – narrated as both metaphor and construction material – as pivotal in Malay proclamations of freedom and independence (*merdeka*). The construction of large buildings, civil engineering projects and monuments enabled the state, the nation, its territory and its ideals to take on an embodied, tangible form. But as Lai points out, it was the very physical properties of concrete that were instrumental in realising a bold, radically new statement of political intent:

> Local architects and engineers were able to create reinforced concrete structures [in their] most technologically advanced manifestation, such as complex systems and thin-shell concrete forms. Used especially for large-span spaces for congregation and commemoration, the buildings and monuments were projected as distinctively novel and national for audiences at home and abroad, and expressed the optimistic employment of modernist architecture's forms and vocabularies (Lai, 2005: 31).

Panning back out then, what we see across Asia in the first half of the twentieth century is a steady shift towards the adoption of new technologies and facilities for large scale construction, new idea(l)s about architecture, urban planning and the role of cities, as well as the uptake of new building materials that dramatically transformed the scale and form of the built environment. As the decades advanced, a modern construction industry was also increasingly defined as such through the standardisation and modularisation of its systems and resources; a process Sigfried Giedion so eloquently documented in 1948.

Within these interconnected processes, the arrival of electronic air conditioning in Asia sometime around the 1930s would prove a significant technological development. At first, and right through to the 1950s and 1960s, the uptake of AC was slow and it remained a rare

technology due in large part to its extremely high installation, operational and maintenance costs. The real beginning of the end of pre-conditional modernity as outlined above, however, came in the 1950s with the arrival of a more techno-scientific language of climatic design in the United States. Chang (2011: 224-5) argues the development of reliable, science-based climatological and meteorological data at that time provided a basis for a new paradigm of architectural practice. It would be some years before the instruments for collecting the indices of climate – like wind speed or effective temperature – would be in common usage across different parts of the world. Nonetheless, a new science of thermal comfort was now filtering outwards from the US, one that divided the world into certain 'zones', with the tropics being sub-categorised into three principal climatic types: warm and humid; hot and dry; and upland (ibid.: 226). Design guidelines for a new science of architecture for these regions followed. But perhaps most significantly, it was a development that would also come to play a key role in the transformation of the material imagination of air; providing one of the foundation stones for a conditional modernity that would subsequently arrive across large parts of Asia.

Conditional modernity

The precise origins of electronic air conditioning in Asia are difficult to trace. As an emergent technology in the decades of the mid twentieth century, its high costs meant it was frequently associated with spaces of luxury. International hotels were among its early proponents, creating temporary respites of comfort from the heat and humidity of the tropical climes. In the case of Singapore, Lee Kuan Yew's (2009: 120) regard for air conditioning as one of the 'signal inventions of history', was also hugely influential in the early adoption of AC in the spaces of work and home. As both the equipment and cost of electricity decreased in relative terms, HVAC systems and domestic air-conditioning units became an increasingly common feature of commercial and domestic buildings across the tropical regions of South and Southeast Asia from the 1960s onwards. Writing in the context of Indian cities, Wilhite (2009: 86) states the adoption of concrete and imported temperate climate design features like large windows, south facing façades and flat roofs in the 1950s set the stage for a rapid take up of air conditioning some decades later, as costs reduced. Most significantly though, these technological and design shifts were accompanied by a series of socio-cultural changes in how air, and associated notions of climate, atmosphere or environment, were understood and materially fashioned. To understand such processes better I follow a line of enquiry articulated by Steven Connor that centres upon:

> the ways in which new understandings of the air entered social experience and altered human experiences of their ways of inhabiting the world…not isolating the air as a specific subject of concern, but…following through some of the ways in which new apprehensions of the air entered into composition with forms of social life and imagining (2010: 14).

Connor cites the invention of gas lighting in nineteenth century Europe as an example of a historical event which is available to such analysis. Gas lighting superseded candles and lamps, representing a technology that transformed the human relationship with light. The illuminating flame and its fuel were now less intimate, of a greater distance and more abstract. Gas piped underground and behind walls was also burnt behind panes of frosted glass that diffused flames into panes of light. Light became predictable, uniform and less prone to localised fluctuations. As Connor notes 'what had previously been proximate, iterative and particular was to become remote, absolute and general' (ibid.: 9). In the introduction of electronic air conditioning in Asia we can excavate a parallel transition. Prior to the advent of

AC, the cooling of the body and attainment of its thermal comfort was achieved in a number of ways, as we shall see. But perhaps the most identifiable parallel with the story of the shift from candles to gas lighting was the transition from the fan to the air-conditioning unit. Much of Asia has a rich cultural and technological history of fanning. China and Japan in particular have long traditions of hand fans, with frames made from bamboo, wood or ivory supporting blades of feathers, paper and silk (Tsang, 2002; Iröns, 1982a). Although China is credited with designing the earliest hand fans, the invention of the folding fan, somewhere between the second and sixth century AD in Japan, brought about a revolution in how they were carried and used as everyday, personal items (Iröns, 1982b: 40). Dating the arrival of the ceiling fan is equally difficult. The history of the *punkah*, a term denoting a swinging blade system attached to the ceiling, is associated with Arab culture. At some point in the eighteenth century the Indian subcontinent adopted the technology, with the *punkahwallah* becoming a feature of colonial rule. The *wallah*, or servant of the house, would operate a pulley system to maintain the flow of air in the room.[4] While the arrival of electricity enabled ceiling and desk fans to become more efficient and regular, cooling was still a process of moving air, rather than introducing new cooler, dryer air into the room. Fanning, both electric and manual, thus remained localised, directional, momentary and a perceptively sensorial experience. In marked contrast, the electronic conditioning of air moved the provision of comfort to the background, whereby its technologies were removed from view, hidden behind surfaces; and in cases where whole buildings, rather just individual rooms, came to be cooled, comfort was 'plumbed' in via channels and ducts that led back to a central source. For the first time then, the ability to chill and dry the air of an entire, enclosed interior meant bodies were able to dwell in and move about spaces of evenly distributed, non-directional thermal regulation.

But the effect of air conditioning was far more than merely an act of disappearance. Its transformative properties become manifest once we look at the role it played in enabling the materiality of a new conditioned modernity in Asia, a transition that was felt first and perhaps most profoundly in a number of Southeast Asian countries. Lee Kuan Yew's (2009) admiration of the technology of 'civilisation' related to the benefits it delivered in work-place efficiency. Quotidian and annual rhythms such as siestas and hill-station retreats were interruptions in the Southeast Asian work-day that could be removed through electronic cooling. The maintenance of 'optimum' temperature and humidity levels throughout the day was also linked to productivity gains, and a marked increase in the attractiveness of cities like Singapore to expatriates originating from temperate climates. But as with laptops, the penetration of air conditioning into the home also meant these became sites of efficiency gains, wherein uninterrupted sleep was the backbone for a more productive workforce (Wyon, 2004; Rijal, Humphreys and Nicol, 2009). It was a powerful logic that saw the work, leisure and homely environs of daily life increasingly move indoors, and the widespread emergence of what Connor has referred to as 'the many enclosures of the air, artificial atmospheres and sealed environments' (2010: 19). Modernity thus became an enclosed one, whereby the aspirations, desires, ideals and activities of modern urban life and urban culture increasingly resided inside. The notion of public space, for example, was transformed, with the contemporaneous rise of consumer economies meaning the indoor shopping mall came to the fore as the rarified eco-sphere of modernity across many of Asia's cities. In the creation of the other 'modern' spaces of public leisure – cinemas, restaurants, hotels and galleries – designers set about creating a new world of indoor capitalism predicated on comfort and

[4] A less technologically advanced, hand-held version of this involved the wallah holding a fan of large feathers bound to a handle.

convenience. Such principles even extended to bodies in motion, as public trains, buses and taxis all came to be classified in a hierarchy of 'Non-AC' and 'AC'. Indeed, as recently as March 2011 Indian Railways proposed to offer passengers 'improved comfort and more exclusivity' via a new 'Super AC Class' (NewKerala.com 2011; MSN India 2011).

Conditioned modernity also gave a new legitimacy to glass as a construction material. The mechanical cooling of interiors enabled glass to evolve from merely being used for windows to being the material of entire walls, and most significantly the façades of office and retail architecture. The adoption of this new 'light' architecture was most apparent in the design of Asia's skyscrapers, where glass began to replace concrete for their outer skins from around the 1970s onwards. Indeed in the case of many high-rise towers, glazed façades involved the removal of window openings as interiors were hermetically sealed in the name of evermore precise climatic regulation. In effect, glass had become a pivotal construction material of a conditioned modernity, at once bringing nature indoors in a visual sense, yet simultaneously withholding it in other ways. As architects adopted glazed façades and roofs to visually 'open up' otherwise dark interiors, they closed in their inhabitants by separating atmospheres, dividing the controllable from the uncontrollable.

Interestingly, where air conditioning has enabled a 'lighter' architecture it has also made possible a culture of heavier furniture and furnishings. AC has underpinned a transformation in interior design in regions like Southeast Asia, in that previously climate sensitive furniture designs and materials employed to allow ventilation and the dissipation of heat away from the body have been replaced by deep pile cushions and heat retaining textiles. In the last thirty years or so, the adoption of AC has been closely followed by a style of furnishing more familiar to the temperate climates of Europe and North America. More specifically, with the 'West' continuing to act as the principle point of reference in the material culture of 'modern' living in Southeast Asia, items like duvets, mattresses and living room seats filled with insulating feathers and foams are symbolically coded and circulate as the focal point of desires and aspirations. Indeed if we recall Shove's (2003) arguments concerning the historical trajectories of comfort and luxury, we are reminded how sinking and snuggling into the soft, malleable fabrics of home furnishings become the embodied practices through which modern, middle-class urban life is marked, felt and lived: a symbolic, sensory dyad enabled by and dependent upon electronic air conditioning. It is now common practice for residential property developers across Southeast Asia to foreground such furnishings, together with thick window curtains and carpeting, as the signifiers of 'luxury' or 'contemporary living'. Lifestyle and home magazines offer a very similar aesthetic, gently conditioning their readers to hold certain aspirations and ideals.

In a few short decades, air conditioning has also had a profound transformative effect on the clothes of Asia. Across the region, the history of clothing is one deeply rooted in local climatic conditions. In tropical and sub-tropical areas, garments were typically loose-fitting and made from fabrics that could 'breathe'. Air conditioning not only removed the logic for such forms of dress, but also facilitated the introduction of new forms of clothing, most notably the Western business suit. In thousands of offices across Asia the standard business attire for both men and women has become the dark-coloured suit made from heavy cotton or wool. In keeping with international business attire, men wear the polyester shirts and ties more suitable to temperate climes. But perhaps most intriguingly, air conditioning has also transformed the material imagination of the body itself in such contexts. The modern, professional body is one free of perspiration and odour. Water, excreted from the skin, is now well and truly out of place in the modern workplace; sweating after all clearly signals losing

one's cool. Despite the year-round temperatures of cities like Singapore and Kuala Lumpur, air conditioning has deemed the productive human body of post-industrial knowledge economies to be clean, dry and free of any signs of climatic response.

Stepping back from these various examples, I wish to suggest then that, together, they add up to two broad trends – what might be referred to as 'epidemics' – which have now secured a firm hold across many of Asia's societies, particularly in the hot and humid countries of Southeast Asia. The first is the widespread, and somewhat viral-like, emergence of electronic air conditioning as a powerful socio-economic and technological complex, one that now both breeds and sustains itself as a seemingly vital component of contemporary life. In a few short decades, AC has become an invisible, yet omnipotent backdrop to modern, urban lifestyles in Southeast Asia. Today, the amount of networked spaces of seamless cooling is expanding rapidly across urban landscapes, meaning that people can now move between the office, classroom, home, restaurant, shopping mall and other climate-controlled environments with minimal exposure to the 'outdoors'. AC thus needs to be considered in terms of the 'path dependency' it has created; a socio-technical system that has come to be 'locked in', with its unforeseen and unpredictable influences and impacts only becoming apparent over time (Abbott, 2001; Dennis and Urry, 2009).

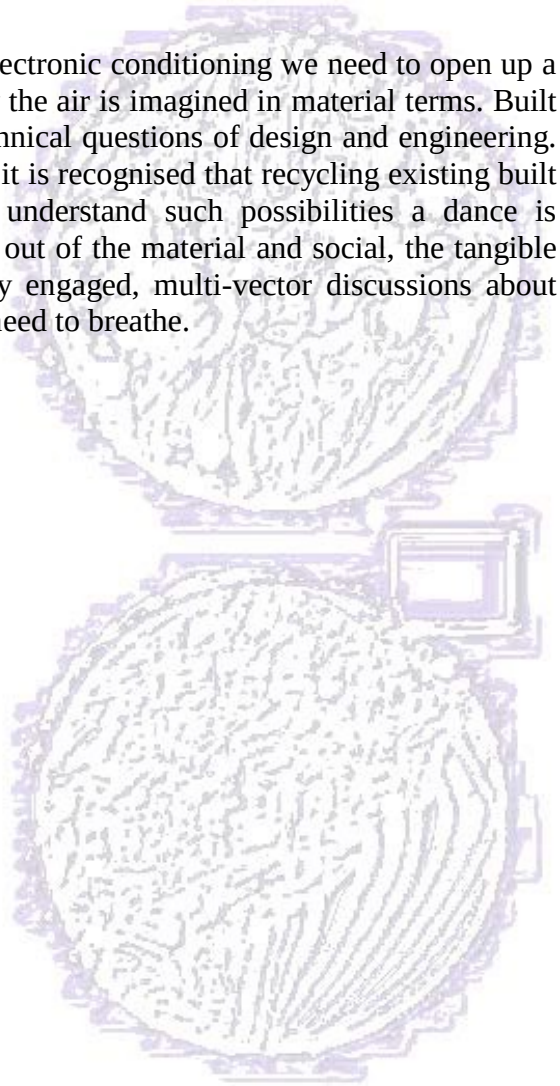
Such trends also speak of a second, and closely associated, phenomenon that has emerged in recent decades, that of a subtle, yet discernible, form of agoraphobia. As a term, 'the outdoors' has always had somewhat vague connotations, but in recent times it has come to be increasingly burdened by anxieties of its vagary. Like elsewhere in the world, in Asia there is a growing fear about the outdoor environment. The outdoors has become a space of contamination and risk, whereby science and associated cultural shifts have rendered air pregnant with concerns about pollution, crime, vector-borne diseases, skin cancer, ageing, and bodily discomfort and impurity. The menace of the mosquito endures, for example, with stories of dengue fever or malaria outbreaks continuing to give a seasonal rhythm to news reporting. Fears and anxieties are often particularly acute in Asia's cities, where industrial scale air-borne pollutants mix with dense populations to create a concoction of deadly haze, smog and disease-carrying water droplets. The cultural and etymological lineage of today's crowded streets in Shanghai, Jakarta and Bangkok brings us back to the agora, or 'places of assembly', of ancient Greek city states. They all share the chaos of densely packed open spaces, and the squeezing and bumping of bodies in confined gathering places. Inhabiting public space is to be walking, commuting and dwelling in the crowd, and whilst many in Asia continue to live and work in densely occupied indoor spaces as well, a sense of privacy, security and comfort therein arises from the proximity of the familial and familiar. Across Asia today an increasing number of daily activities are moving indoors, whereby, in Lefebvrian (1991) terms, 'hermetic' interior space is both conceived and perceived as safer, more hygienic, more convenient and of course more comfortable than the outdoors.

Towards an alternative: An unconditional modernity

The possibilities and limitations for recycling buildings thus need to be seen through this prism of indoor/outdoor spaces. Indeed what I have suggested here is that the electronic cooling of interior spaces has been far more significant than merely a feature of building technology, and instead should be read as the catalyst for a new form of built environment modernity. The wholesale transformation of the material imagination of air presents major obstacles for re-using buildings that don't comply with the demands of today's AC paradigm.

If a more sustainable built environment is to be developed in Asia, we need to move towards a more *unconditional* modernity. By unconditional I mean we unhook AC as the axial technology and culture of indoor living. This is not an argument for abolishing air conditioning, a proposal that would rightly met by a rebuttal of naivety. Rather it is a proposition concerning its de-centring in the name of creating alternative, low carbon trajectories of thermal governance. The invisibility and intangibility of air is a significant factor in its absence from public debates about climate change and sustainability. Air too often remains in the unconscious background, far beyond the robust, critical debates about the material world. An unconditional modernity is one where this imbalance is better addressed, where understandings of the climate of the everyday and quotidian are pursued much more rigorously. The themes explored here illustrate how the possibility of recycling buildings and interior spaces that were built prior to electronic cooling and are to be used without such technologies today raises questions about furniture, clothing, furnishings and the politics of the body. Certain assumptions and norms about these now have to be reassessed and de-stabilised, in ways that open up alternatives to electronically conditioned interiors. An unconditional modernity probes such questions and assumptions, in the search for alternatives. It is a modernity that revisits the fan, allows the air to move again, and questions our rising phobia about the outdoors.

Put simply, if we are to alter the current path of electronic conditioning we need to open up a new material imagination of air, and redefine how the air is imagined in material terms. Built environment sustainability is much more than technical questions of design and engineering. Indeed, what has been revealed here is that, while it is recognised that recycling existing built structures has clear environmental benefits, to understand such possibilities a dance is required, one that takes us back and forth, in and out of the material and social, the tangible and the intangible. Only then can more critically engaged, multi-vector discussions about built environment sustainability have the air they need to breathe.



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