Architecture of **(Im)**permanence

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Jed Long was awarded the Byera Hadley Travelling Scholarship in 2016.
Cover Image: The Light of Shodoshima by Wang Wen Chih.
Image: Wang Wen Chih

Architecture of (Im)permanence

Everything is temporary, only the consequences are permanent...

.....

1

Introduction

"the constant search for uniqueness results in sameness and repetition"

- Juhani Pallasmaa -

A discussion of architectural permanence begins with the recognition that it is not a dichotomy. Nothing is permanent or impermanent, rather everything exists at varying stages of impermanence, reflecting Hiroshi Ota's idea that design is just a moment within a continual state of material flow[1]. As architects our desire to create is often linked to the need to make ones mark, to leave behind a cultural marker of creativity. Within the context of rapid overconsumption of finite resources, it is worth questioning why we build at all, as every act of construction is also an act of destruction[2].

Humanity's desire to leave a built legacy can be traced back to well before Vitruvius enshrined *firmitas* as part of his treatise *De Architectura*. The pyramids of Giza, the Parthenon or any number of ruins littered across Western architectural history tell a tale of how material durability equates to architectural permanence. If we look at the Great Wall of China we can see that it is not that simple. Only about 8% of the wall remains in good condition[3], as weather erosion and human damage ensure its continual decomposition. Chinese infrastructure projects have seen portions demolished for roads and energy projects, impoverished locals use it as a source of building materials and tourists can illegally acquire their own piece of the wall for as low as $5[4].

Architectural historian Lu Zhou describes this by saying, "In Europe cathedrals are monuments, but for the Chinese, temples are more like clothes...We wear them, then take them off, or throw them away. For us, function is more important than history."

Perhaps the origins of these notions can be traced to Buddhist and Hindu philosophy, where the transience of existence forms part of a natural cycle of growth, life, decay and death. Whereas the polytheistic and monotheistic religions that have dominated Asia Minor and Europe for thousands of years, underpin our desire for eternity through unchanging built form.

The notion of building as monument that is historically demonstrated in western architectural discourse has never been more evident than when we examine the contemporary built environment. Globalisation has brought the world together, but in doing so has facilitated the "casual eradication of distinctive places and the making of standardized landscape that results from insensitivity to the significance of place."[5] The contemporary cityscape is one of concrete, steel and glass, irreverent to site or cultural context. The benefits of building with these materials are abundantly clear as it enables us to construct forms never once thought possible. However the pursuit of the simplest and most cost effective solution, comes at a cost that is social, cultural and environmental.

should architecture aspire for longevity? Or can architecture successfully assimilate its own obsolescence...

- Inflection, Vol.4-

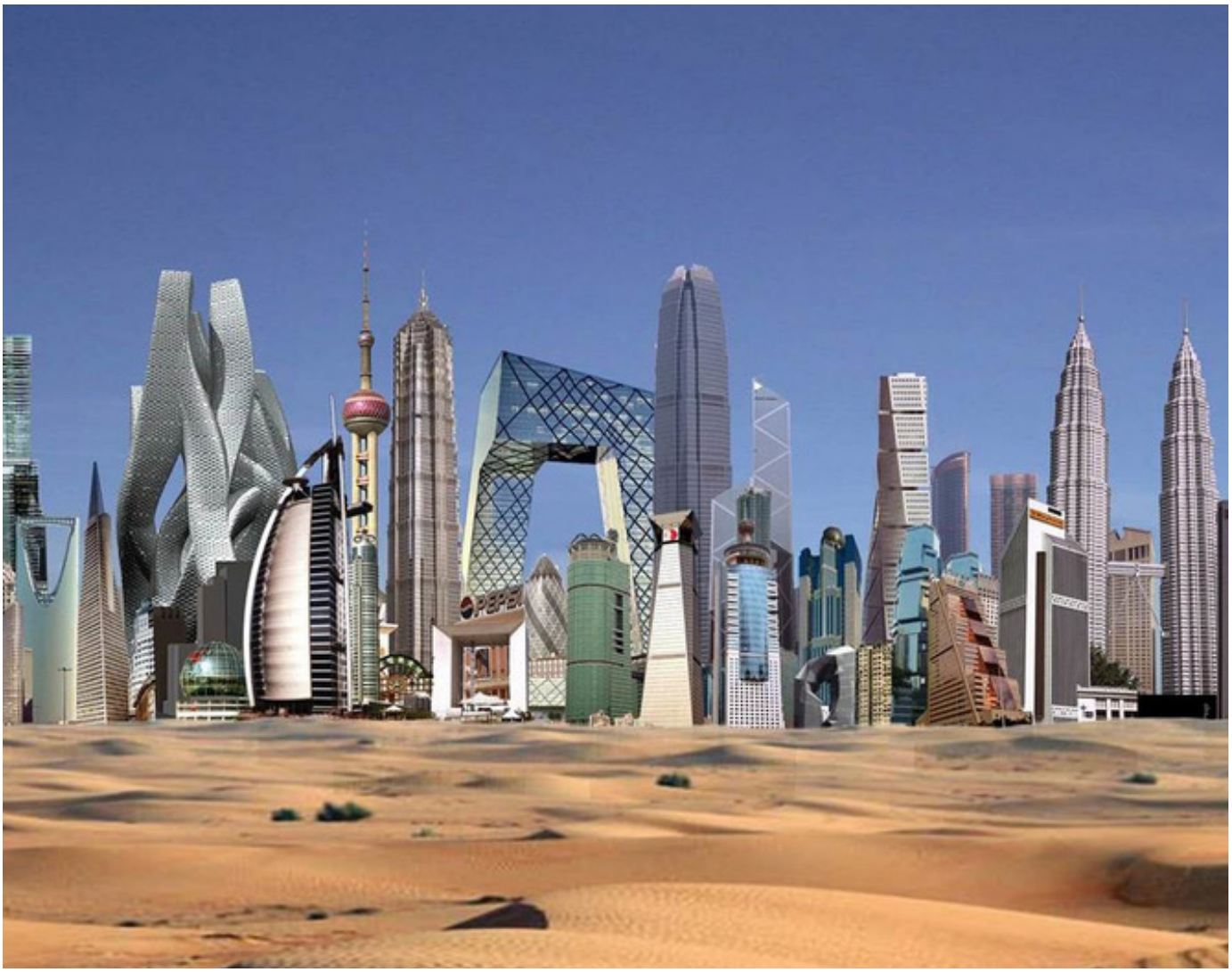
Juhani Pallasmaa states that "the constant search for uniqueness results in sameness and repetition"[6]. By celebrating the aesthetic and structural qualities of buildings above all else, buildings are left vulnerable to the volatility of contemporary society where mass migration, global warming, speculative development and a litany of other factors render buildings obsolescent. The notion of *firmitas* as an absolute truth, thus requires scrutiny in a society defined by relativity . It is worth questioning whether architecture should even aspire for longevity, or should it instead be designed for obsolescence and change.

The recent destruction of Sydney's Darling Harbour precinct, demonstrates that material durability or even 'iconic' design does not equate to cultural longevity. The Darling Harbour Exhibition Centre, built in 1988 contained 2000 tonnes of steel and 70,000 tonnes of concrete[8]. The embodied energy and durability of these materials demand that a building lasts longer than 30 years. Unfortunately this is not the case and globally we can see the constant cycle of destruction and reconstruction play out again and again. This will continue as long as the economic imperative is allowed to dictate architectural production.

There is no single answer to this problem and it is likely that there may not ever be one. However by examining other ways of practicing architecture, there is at least the opportunity to reflect on how it can be done differently.

Above: Demolishing the Darling Harbour Exhibition Centre. (Image: Edwina Pickles)

Below: Advancement vs. Apocalypse (Image: OAM)



2

(Im)permanence

"Society never advances. It recedes as fast on one side as it gains on the other... For everything that is given, something is taken."

- Ralph Waldo Emerson-

Left: Bahareque, Colombia

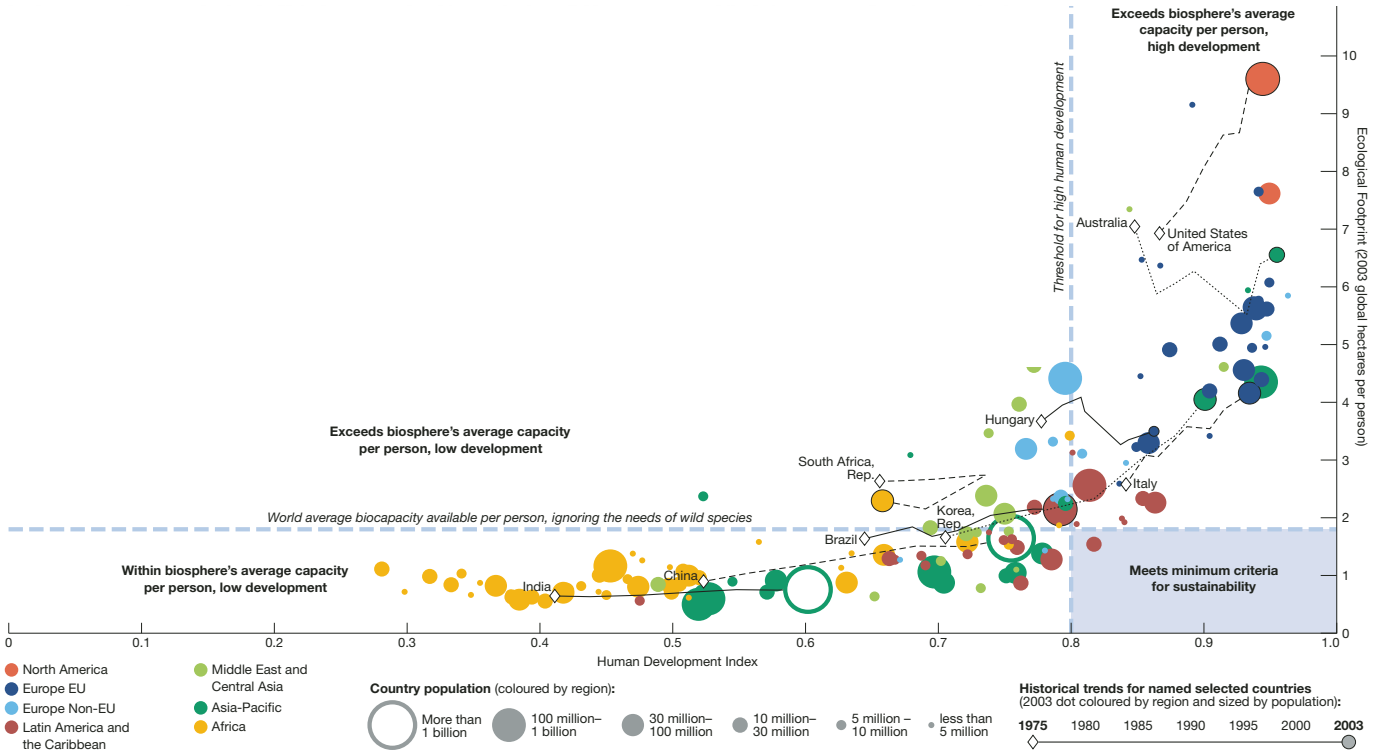
The convergence of architecture towards a singular homogenous language has led to the erosion of distinctive styles that once responded directly to culture, place and climate. Examining the notion of architectural permanence requires one to move beyond physical and material properties of architecture and focus upon the cultural and ecological implications of architectural intervention. If the erosion of cultural authenticity has rendered places inherently meaningless to most of their users[9], how can cultural longevity then be achieved?

The Eiffel Tower was built for the 1889 World's fair and was designed to last only twenty years. However one hundred and twenty nine years later it is now the symbol of Paris and France. During this time every single one of the Eiffel Towers 180,000 steel member have been replaced at least once. This process recalls Plutarch's analogy of the 'Ship of Theseus', where having left port, Theseus spent several years at sea, during which time every piece of his ship was replaced. In telling the story the question is asked, at what point did the ship stop being the original object and become something else.

Japan's much revered shrine Ise Jingu, provides the material embodiment of this paradox. Reconstructed on adjacent plots of land approximately every twenty years, the shrine dates back to 4 BCE. Is it the same building or is it something else? The irreverence towards permanence demonstrated in Shinto culture can be traced back to the *Vastu Shastra*, the original Hindu manual on the science of architecture and the basis for the notion of *feng shui*. One section of the *Vastu Shastra* prescribes particular methods for constructing a temple. One key requirement was to plant an invasive and fast growing tree in the centre of the courtyard. As long as the temple was valued, there would be someone to care for the tree and ensure it did not spread. However, once the temple lost its relevance and was no longer cared for, the tree would be able to spread and eventually over run the complex, returning it to nature[10]. Implicit in this narrative is the notion that the building was designed for its eventual obsolescence.

Architecture can be seen as the physical embodiment of the collective psychology of a particular time and culture[11]. The rapid rate of consumption and destruction that is taking place globally reflects the changing nature of society where speed and immediate satisfaction often result in short term outcomes. Milan Kundera writes that "there is a secret bond between slowness and memory, between speed and forgetting."[12] In our desire to advance and create efficiencies, what are we then leaving behind and what is being sacrificed in the unending pursuit of growth and progress? Toyo Ito describes this condition as 'floating' and believes it reflects the way our lives are increasingly being played out as pseudo-experience, facilitating the slow detachment from reality[13].

In only the last 25 years, humanity has destroyed a tenth of the Earth's remaining wilderness[14] and inequality has risen across all societies[15], yet we are fixated on the notion that progress leads to a higher



Above: Human Development and Ecological Footprints, 2003 (Image: Global Footprint Network and WWF-Living Planet Report 2006)

quality of life. The 2006 Living Planet report by the World Wildlife Foundation set out a threshold for available bio capacity per person[16]. The report depicts an exponential curve where increased development equates to an ecological footprint far above what the planet is capable of sustaining. In the rush towards development the vast majority of the world's population will soon exceed that threshold. However they are merely following in the footsteps of countries like Australia or the USA whose ecological footprint per capita is four to five time higher than the sustainable limit.

Vernacular architecture offers an antithesis to the mass urbanisation and homogenisation we see taking place particularly in developing countries. Vernacular architecture demonstrates a direct response to place, culture and time. The typological characteristics of various vernaculars are shaped by the climate and local material availability. James Lovelock describes the evolution of species and their environment as tightly coupled and evolving as a single system[17]. Given the relatively new dominance of an urban architectural condition, it is worth questioning how a new architectural vernacular can exist within a setting of limitless access to materials and the capacity to control environment through mechanised means.

Traditional vernacular built form is seen by some as demonstrating a deep connection between human and environmental concerns. However in a contemporary context the challenge arises from tradition being often incorrectly seen as nostalgia, rather than as a road map for how people have existed in that context for thousands of years. T.S Elliot once wrote that "tradition is not static, it must be reinvented by every generation"[18]. Pritzker laureate Wang Shu embodies this idea through work that transcends the dichotomy of new versus old, stating "a lost tradition means a lost future"[19].

It is easy to lose sight of how the last one hundred years has brought about change never seen in human history. Within a single generation, countries have undergone transformation from agrarian societies to urbanised members of the global community. It is inevitable that this change will occur, and great benefit will be derived from it. However, the speed at which this transformation is taking place is causing untold damage to the environment, society and cultural traditions.

Because of the negative impacts of development, it is worth questioning why we continue to pursue it with such vigour. Yuval Harari when discussing the notion of happiness, relates its unattainability to expectation. As things improve, expectations balloon and as such satisfaction remains out of reach[20]. This analogy is apt when considering how developed countries continue to consume at a higher and faster rate, raising a bar that the rest of the world aspires to reach. These demands result in a constant state of impermanence where the only permanent legacy is the environmental and social damage caused.

“the flow of cultural homogenization is creeping rapidly across the built world. The speed of today’s industrial growth is blanketing a tsunami of poetic loss”

- Travis Price -

Below: Ise Jingu (Image: Ise Shrine)

“tradition is not static, it must be reinvented by every generation”

- T.S Elliot -

The following chapters offer examples of how varying states of impermanence are present in the built environment. Key to this discussion is the recognition of context in determining the appropriate response. The materials and manner of construction for any project are dependent upon the use of the building, its location, the anticipated future change and the social and cultural consideration of those using it. The parameters for selecting an appropriate building solution in a development context are vastly different to those faced in an urban context. However underpinning all of these situation is the recognition that currently social, cultural and environmental concerns are not being adequately addressed through built form.

Right: Rong House, Ro Koi, Vietnam
The communal house and cultural focul point for Bahnar and Giarai ethnic minorities. Found in the Central Highlands of Vietnam, they can be up to 30m tall and are often constructed from the hardwood timber of the proceeding Rong.

3

(In)security

"shelter is a process, not a product"

- Dave Hodgkin -

Left: Dadaab Refugee Camp, Kenya (Image: Brendan Bannon, 2011)

Architecture is a fundamental part of human existence because of the intrinsic connection between shelter and well-being. War, resource insecurity, natural disaster, changing climates and racial tensions continue to displace huge populations of people seeking shelter in rapidly growing informal settlements. Over the course of this scholarship the world has witnessed the Rohingya genocide, families separated at the US border, the Syrian refugee crisis, the continue unlawful offshore detention of refugees in Australia, not to mention the less documented humanitarian crisis taking place in Yemen, South Sudan and a number of other countries. We have also witnessed the destructive capability of Hurricane Irma, flooding in Bangladesh and Pakistan and the California wildfires. In the United States alone the cost of natural disasters in 2017 was $306.2 billion[21]. The resilience of a country to respond to these issues is varied and a large portion of the world's most vulnerable countries are located in regions where climate change is multiplying the effects of war, drought, natural disasters and ethnic tension.

Sean Anderson explored these concerns through the curation of Insecurities: Tracing Displacement and Shelter, at New York's Museum of Modern Art (MoMA). The exhibition highlights the reality of "over 60 million persons in the world today, (for whom) shelter is defined through constant movement or escape."[22] It's focus is on the complexity of circumstances that bring about displacement and the challenge of how the built environment responds to displacement. Often countries that house these growing refugee camps refuse to recognise them, leaving the residents deprived of the most basic human rights and left in a state of permanent temporality[23].

Design has a role to play in the context of displacement and shelter. Don Weinreich and Eliza Montgomery describe refugees as 'actors with agency' and informal settlements as 'cities to be connected to their surrounds, not isolated communities'[24]. Rather than prescribing any singular design solution, Weinreich and Montgomery provide a design framework they call a toolkit to provide fast and simple site analysis and design tools. The tool kit was the result of cataloguing adaptable 'good practices' that could be used to aid humanitarian responses. Dave Hodgkin, founder of Humanitarian Benchmark Consulting (HBC) agrees with the notion of 'good practice' and cites the work of the late Paul Pholeros and Health Habitat as an exemplar case study of good practice in action. Hodgkin sees "shelter as a process not a product" and describes the process as a "range of strategically targeted minimal interventions designed to ensure affected households can live in dignity, safety and transition smoothly from inadequate temporary shelter to permanent safe housing"[25].

The key criteria in determining good shelter are
-Safe
-Adequate
-Durable
-Appropriate
-Supports transition

"Humanitarian aid responds to the immediate needs of the population... it is not a space for experimentation as any failures will be magnified by the fragility of the local economy"

- Fabian Prideaux -

In most instances, the role of the architect is minimal in any humanitarian response. Unlike development aid, humanitarian aid responds to the immediate needs of the population and is concerned with short term objectives[26]. It is not a space for experimentation as any failures will be magnified by the fragility of the local economy.

Rather a designer can ask the questions;

-Who has found adequate shelter and what did they do?
-Who hasn't and why not?
-What are their barriers and how can they be overcome?

In asking these questions there is an implicit questioning of what existed before, what is the current response and what will the future solution look like.

The challenge for any designer in this context is to continually reflect on the nature of why we design. Often the result is an architecture of transition or impermanence, but with permanent environmental and social implications. Architectural failure in this realm often then occurs when innovative and novel design take precedence over practical and appropriate responses that draw on existing knowledge and custom.

Humanitarian Benchmark Consulting witnessed the ramifications of this process first hand during the reconstruction of Jogjakarta after the 2006 earthquake. The International Federation of the Red Cross, along with other NGO's saw the recovery program as an opportunity to utilise bamboo, given the long history of bamboo architecture in the region. Over a period of 9 months, more than 75,000 shelters were constructed at an average cost of $150 USD[27]. Built by local communities, the program adapted traditional construction techniques of rope and dowel joints, to construct buildings with a higher resistance to earthquakes. It was an ideal example of utilising local wisdom for reconstruction, aided by sensitive technical support. By all measures the program was a success, except for one issue- the prescription of bamboo as the material of choice led to the deforestation of vast tracks of bamboo forest throughout the region. As a result local communities lost a valuable resource, decreasing resilience for future disasters.

The conflict of the humanitarian imperative against long term ecological and social consequences, is a recurring issue in post disaster reconstruction that is becoming increasingly prevalent. As a resident of Jogjakarta during this process, Dave Hodgkin saw this as a wakeup call for the international aid community and their understanding of bamboo. The Humanitarian Bamboo Project was subsequently established as a means of educating the shelter cluster in best practice for bamboo cultivation and construction. Through a series of grants and extensive workshopping with experts, the Humanitarian Bamboo Guidelines were published. Created as an open source document, the guidelines are often revised and updated to ensure accuracy of information. Although meant as a resource for post-disaster reconstruction, the guidelines

Above: Design for Post-Disaster Reconstruction, was a workshop run in collaboration between Humanitarian Benchmark Consulting and Cave Urban. The workshop focused on developing shelter typologies utilising bamboo and the contents of a Red Cross Shelter Kit. (Image: Fabian Prideaux)

Below: Discussing best practice for bamboo cultivation with Dave Hodgkins during a Humanitarian Benchmark Consulting shelter training. (Image: Fabian Prideaux)

Because of widespread deforestation, timber is no longer a renewable resource in many developing contexts...

Right: IOM discussing best practice roof design with local community members as part of their One Room Shelter Program. The program built upon traditional Pakistan building typologies that utilise earth construction and bamboo.
(Image: Joseph Ashmore)

provide a wealth of information about all stages of bamboo cultivation and construction that is applicable to anyone looking to utilise the material.

Dr Michael Ramage and Dr Elizabeth Wagemann of Cambridge University's Centre for Natural Material Innovation sought to build upon the work of HBC by conducting a scoping review of bamboo construction in Pakistan. The aim of the research was to identify how bamboo is currently being used in informal architecture and as temporary shelter. The focus was on how barriers can be overcome to improve construction methodologies and material availability. Whilst the review is specific to Pakistan, it sought to identify broad issues and challenges that are present in many other developing countries faced with increased human displacement from natural disasters.

Dr Ramage and Dr Wagemann chose to focus upon bamboo as a material because of its rapid cyclical growth pattern and mechanical properties similar to that of timber[28]. Because of widespread deforestation, timber is no longer a renewable resource in many developing contexts and as such bamboo has been identified as a material capable of restoring landscape and providing a regular renewable supply of building material. The challenge lies in educating farmers on best practice management of clumps, correct harvesting technique and treatment methods.

The review found that bamboo was often used informally as a roofing structure and that it was frequently employed as a material for reconstruction after natural disasters. However the review encountered a key challenge faced by academic institutions seeking to further research on bamboo construction- the disconnection between academic research and local holistic knowledge.

Dr Bhavna Sharma of the University of Bath's Centre for Innovative Construction Materials, stresses the need to challenge the bias towards the un-modern as less than. Engaging with a non-biased agenda when assessing the efficiency of vernacular construction is a necessary step towards a larger holistic understanding of the vernaculars role in the built environment. Over emphasis upon the empirical methodologies of colonial institutions often neglects the embodied knowledge of the existing culture. As such research and the move towards standardisation and innovation are just as important as improving the pedagogical models that allow for information to be spread through informal channels to improve the standard of informal construction.

Above: Constructing the maloca at Organizmo, Colombia. The process of construction is as important as the structure itself.
(Image: Organizmo)

“Overemphasis upon the emperical methodologies of colonial institutions often neglects the embodied knowledge of the existing culture”

"The line I trace with my feet walking to the museum is more important and more beautiful the lines I find hung up on the walls"

- Hundertwasser -

Colombian organisation Organizmo Design Build Centre, focuses on community empowerment through local knowledge and resources, developing educational models that emphasise participatory and cyclical methods of building.

The founder of Organizmo, Ana Maria Gutierrez has been developing a pedagogical model for the reconstruction and conservation of the different ecological and social ecosystems in Colombia. The headquarters of the organization in Tenjo, just outside of Bogota plays host to several different initiatives that Gutierrez and her team have implemented over the last decade. By focussing upon education, Organizmo seeks to strengthen the intangible cultural heritage of communities within Colombia and the surrounding Amazonas. This process in turn opens up a dialogue on the role of traditional vernacular knowledge within a contemporary setting. The focus upon intuitive technology and the implementation of pedagogies for self-construction, builds upon the work of similar organisations such as TIBA that recognise the prevalence of informal architecture and the contemporary eradication of vernacular knowledge.

Organizmo's Centre for Bioconstruction in Tenjo housed a number of different architectural typologies that had been created through a series of different workshops hosted by local and international artisans and architects.

The Maloca, a traditional ceremonial building indigenous to the region that was constructed from bamboo and timber, was of particular note. The building utilises on ground pre-fabrication as a method of overcoming the absence of any machinery throughout the construction process. It also incorporates fire as a ritual ceremony that not only strengthens cultural heritage but also serves to preserve the building from insect infestation and mould.

Architecture within a humanitarian or development context may result in temporal or material impermanence but often involves a cultural or environmental permanence. The process of transition enables basic human needs to be met and improved but can also come with an environmental cost that often reduces resilience in the long term. These analogies are specific to particular contexts but are just as applicable for examining the wider built environment. If architecture is a process not a product, we can question why some people are able to achieve this and why others are unable to do the same.

Above: Barrio Los Andres, Manizales, Colombia. Houses in this region have been traditionally constructed from bamboo. The bamboo is often rendered in bahareque (wattle + daub).

Below: The maloca at Organizmo, Colombia. Each community has a maloca with unique charachteristics that can be either male or female.

4

(Agri)tecture

Agritecture provides an opportunity to explore a bio-based economy where the intersection of architecture, agriculture and agroforestry provides new ways of seeing the built environment.

Left: Harvesting Bamboo, Crystal Waters (Image: Kai Wasikowski)

In 1786, just prior to the Industrial Revolution, Francois Cointeraux founded the School of Agritecture in Grenoble, France and a subsequent school in Paris in 1788. The school taught students the science of agriculture couple with the skills to create buildings from local materials. However, the onset of industrial capitalism marginalised agrarian values and the notion of agritecture never took hold[29].

Agritecture can be broadly understood as 'the art, science and practice of integrating agriculture into the built environment'[30]. In contemporary discourse, agritecture once again provides an opportunity to explore a bio-based economy where the intersection of architecture, agriculture and agroforestry provides new ways of seeing the built environment. This definition is broad enough to provide agency for those not traditionally considered as contributors to architectural production. By considering the direct environmental and social implications of our material consumption the way in which we design can be assessed upon how appropriate it responds to the given cultural, social and ecological context of the brief.

Through application of the principles of agritecture to a development context, there is opportunity to explore how architecture may help mediate the relationship between a community and its surrounding environment. The rapid change that the onset of the industrial revolution caused in western Europe is now playing out at a faster rate in the developing countries of South-East Asia where countries are transitioning from agrarian societies to integrated members of the global community in a single generation.

In countries like Vietnam, the result of this transformation has seen average annual income rise from US $100 in 1986 to US $4000 in 2016[31]. However, in rural Vietnam this change has not been as beneficial and annual income remain at US $200, reflecting a vast disparity between the urban and the rural economic ecologies. Two thirds of Vietnam's population of 96 million still live in rural areas, where there is a poverty rate of 22%[32]. Shifting agricultural practices and increasing urbanisation have resulted in both positive and negative outcomes for these communities. The widespread deforestation caused by the Vietnam War and the subsequent introduction of a capitalist economy has begun to be remediated through the reinstatement of primary forests[33] that in has returned tree coverage to almost pre-war levels. However, this process has resulted in the implementation of monoculture forestry and cash crop farming practices that has led to a lack of biodiversity, soil degradation and watershed issues[34]. The ramifications of these environmental stresses will be multiplied as the impacts of climate change intensify. As such the rapid change and economic value of development needs to be understood in relation to the environmental and social cost of this transformation[35].

The Byera Hadley scholarship provided an opportunity for Cave Urban to collaborate with the University of Tasmania to explore the notion of Agritecture through the Vietnam Bamboo Project. The project partners with existing agricultural programs to develop prototypes for low-tech, hybrid construction systems that can be self-built by communities and draw on vernacular traditions and local material resources[36]. Working directly with communities provides a context through which the most appropriate architectural solution may be determined. This process considers materiality as part of an economic, ecological and social supply chain, providing a holistic understanding of the impacts of material choice and construction techniques.

Above: Suoi Re Community House by 1+1>2. Vietnam. (Image: 1+1>2)

Right: UTAS students building a cattle shelter in Long Luong for Vietnam Bamboo #3. (Image: Helen Norrie)

The result of the research undertaken through both the Byera Hadley scholarship and a subsequent Churchill Fellowship resulted in the dissemination of this information through several formats. The following text has been taken from a paper written for the 2018 World Bamboo Congress, entitled the Global Bamboo Collective[37].

"There is a long tradition of bamboo building in Vietnam, in which bamboo was traditionally part of a hybrid system of construction that also included hardwood timber and thatch. In the colder northern regions of the country, split bamboo is utilised as a substrate over which mud is applied in a manner similar to wattle and daub or *bahareque*[38]. Increasingly concrete and masonry has replaced these traditional methods of construction, with bamboo being relegated to the status of 'poor man's material'[39].

Hoang Thuc Hao, of Vietnamese architectural practice 1+1>2, continues the tradition of utilising bamboo as part of a hybrid system of construction. Working with a broad material pallet, Hao designs community buildings that simultaneously evoke feelings of tradition, whilst sequencing space and program using modernist principles of design. Each of 1+1>2 buildings respond directly to the context in which they are created. Traditional methods of joining bamboo with dowel and rope are utilised and there is a low-tech simplicity to how the buildings are constructed. Yet complexity is established through the highly though out series of spaces and the way in which multiple materials are utilised to optimise their material qualities[40].

The skill in Hoang Thuc Hao's work is that on first inspection, his buildings do not distinctly read as bamboo architecture. Rather they are representative of the notion of contemporary vernacular, where traditional building methodologies are re-contextualised in alignment with modernist aspirations. By separating a material ideology from design, he create's work that can be appreciated for its spatial and programmatic qualities alongside the strong social and environmental agenda that is present in his work.

The rapid change Vietnam is undertaking from an agrarian economy to a highly connected part of the global community is causing distinct change to its urban landscape. Vernacular building methodologies have been replaced by a taste for new buildings methods, processes and materials[41]. The loss of cultural character, particularly in urban environments has begun to be recognised and emphasis has been placed on the notion of 'homeland' (a connection to cultural heritage). Bamboo has subsequently emerged as a symbol of Vietnamese culture and often forms part of a nostalgia for a traditional way of life. Subsequently it has begun to be recognised as a high-end material in contemporary architecture that utilised sophisticated methods of construction. However, this has not served to protect traditional low-tech methods of working with bamboo from being replaced by masonry construction.

Vo Trong Nghia (VTN) has developed an international reputation for his iconic bamboo buildings, starting with the first project for the Wind and Water Café in Ho Chi Minh in 2006. VTN's distinct methods of construction combine the structural and material qualities of Vietnamese bamboo with a Japanese architectural education. Traditionally bamboo in Vietnam was constructed on two-dimensional planes, often as a series of frames. The architecture of VTN innovates through the application of a three-dimensional structural systems that utilises bundled and curved elements of

Above: Raw Impacts, Every Piece Matters housing program in Phnom Penh, Cambodia. Developed in collaboration with UNSW, Casey Brown Architects and Cave Urban

Right: Sen Village Community Centre, Ho Chi Minh City, by Vo Trong Nghia

bamboo. Utilising small diameter but solid bamboo VTN constructs truss's and arches that form spaces on a monumental scale as can be seen in his design for Naman Retreat or Sen Village Community House.

The iconic forms of VTN's structure are highly expressive and evoke a nostalgia for the vernacular but utilise high-tech construction techniques[42]. Through extensive international recognition, VTN has come to represent bamboo architecture in Vietnam. Many derivative organisations have been inspired by the unique method of construction seen in VTN's work, subsequently raising the profile of bamboo as a building material in Vietnam.

Dr Helen Norrie observes that VTN's work has become key icons in the global 'iconomy', the imaged based economy of marketing and architourism[43]. Demand for VTN's work is driven by restaurants and resorts seeking to market themselves utilising bamboo and VTN's distinct architectural style. Similarly works such as Sen Village Community House and the Diamond Island Community Centre have been commissioned by developers to serve as icons of a narrative that evokes a traditional way of life. The utilisation of bamboo as marketing presents a contradiction that risks bamboo being seen as a fad if it becomes too closely associated with iconography.

Raising Awareness Worldwide (RAW) Impact is a NGO based in Phnom Penh, Cambodia. Founded by Australians Troy and Nicole Roberts, RAW Impact works directly with highly vulnerable Cambodian communities focussing on capacity building. The organisation's core principles to sustain, educate and protect, address diverse issues, establishing pathways for families to avoid debt slavery and child sex trafficking by providing education and a sustainable lively hood, as well as providing better housing and more secure land tenure.

Cambodia is an agrarian nation, with a largely rural population, whose people rely upon natural resources for food and income[44]. Over the last thirty five years, Cambodia's population has tripled from five million to fifteen million people as it recovers from the atrocities committed by the Khmer Rouge. The exploitation of diminishing resources is being amplified by the growing population, 36% of which is living below the poverty line[45].

RAW Impact has identified bamboo as a resource capable of addressing some of the issues confronting Cambodia, providing multiple beneficial outcomes that includes housing, environmental remediation and employment. Working in collaboration with the University of New South Wales, Casey Brown Architects and Cave Urban, the Every Piece Matters program was established to design and construct housing prototypes. The process of building seven housing modules provided a means of educating local workers in bamboo construction, whilst also serving as a means of learning through making for all participants in the project. A continual process of critical reflection has allowed for the gradual evolution of designs towards an outcome that is suitable for bamboo construction and local ways of living.

Key to this process was the recognition that it was an iterative process that allowed for feedback from those involved and external consultants to guide the evolution of the designs. Troy Roberts describes innovation as a core value, stating "We're not afraid to fail and learn from it, and we're willing to try out-of-the-box solutions to some huge issues"[46]. As a result, over a period of two years there has been distinct improvements in construction knowledge along with social integration with the local community.

Above: New housing typologies developed by RAW Impact in response to community feedback. The new designs demonstrate protection through design and improved construction methodologies.

Right: Young Khmai workers are trained in bamboo construction as part of a capacity building program for the local community.
(Image: Nina Annand)

The most recent designs reflect a number of improvements that include:

-simplification of the buildings programs that recognises the majority of time is spent on the ground plane beneath the shade of the house and a single room is required for sleeping.
-utilising rope and dowel connections in place of threaded rod.
-concrete footings to raise the bamboo posts above flood water.
-larger eaves to protect the walls from rain and sun

The social context of the project presents a situation where social impermanence sits in alignment with a material impermanence that may mean a build needs to only last ten to fifteen years for a number of different reasons. RAW Impact is looking to extend this timeline by working with the local community to address social challenges and improving construction and treatment processes to improve material longevity. All the bamboo is now treated onsite to prevent degradation and building design has been refined to minimise the effects of weathering.

The construction process has been set up to allow for capacity building of the community. Training young Khmai workers who may not have any building experience requires a system of construction that is repeatable and ensures a level of quality control. A series of jigs have been fabricated which allows for all work to take place on ground and repeated to achieve a higher level of efficiency. Previously work had taken place in-situ and had posed a number of challenges that prefabrication on ground solves. Low-tech innovation such as this is highly suitable to the circumstance and presents a simplified methodology that is an appropriate response and an opportunity for changing perceptions about bamboo as a building material.

The individual buildings are carefully arranged to form a village, allowing an increased permanence for the community. However the contextual fluidity of the project suggests that housing may only need to last ten to fifteen years before the context in which families are living will have changed and a different housing solution is required. Working with bamboo allows the material resources to fit the contextual requirements of architectural fluidity.

RAW Impact is working on improving housing for the lowest socio economic bracket and developing typologies that suit the particular cultural context in which they are working. By creating simple low-tech solutions to bamboo architecture, RAW Impact is going a long way towards demonstrating how bamboo can remain relevant for those seeking a more secure life.

The impact of development upon the culture and environment of the countries in which it is taking place, provides an opportunity for agritecture to explore alternate futures where architecture, agroforestry and agriculture are integrated to improve economic and ecological resilience.


IMPACT

5

(Un)modern

"The idea that materials have a particular nature has an immediate appeal, but it requires only a moment's reflection to realize that it is far from straight forward."

- Richard Weston -

Left: Oakwood Tower by PLP Architects developed in collaboration with Cambridge University's Centre for Natural Material Innovation. A proposition for a 300m tall wooden skyscraper in the centre of London. (Image: PLP Architects)

It is easy to be prescriptive about better ways of practicing architecture can be achieved when examining architecture of displacement and transition. The challenge is to build upon these ideas and apply them to our own contemporary urban context, otherwise the only effort to change is being imposed upon those least resilient to change.

The rate and manner in which materials are consumed in urban built environments are one of the major contributors to a degraded natural environment and increasing emissions. Rising population and consumption levels are increasing demand for increasingly scarce materials and energy sources that are fossil fuel based. The overconsumption of the Earth's resources has led to three interrelated global environmental problems[47];
- Depletion of resources
- Deterioration of ecosystems
- Deterioration of human health

The building industry is vital to housing the growing urban population worldwide, but that does not entitle it to the indiscriminate use of resources in pursuit of this goal. The built environment currently consumes over 50% of all extracted materials[48] and this overreliance on non renewable resources has a multitude of negative effects that are often hidden from those who inhabit its buildings.

The challenge faced is how to transition away from a fossil fuel based economy that relies on extraction towards a circular economy with an emphasis upon renewable and bio-based materials[49]. The industrial revolution radically changed the way in which we build and it is now time for us to astutely utilise these materials with awareness of their impacts.

The Centre for Natural Material Innovation (CNMI) at Cambridge University was established to bring together scientists, engineers and architects to uncover new means of working with natural materials that can be applied to the contemporary built environment. Two of the potential avenues of research that have been identified are engineered bamboo and engineered timber for high rise construction.

With any renewable resource the challenge is in balancing supply and demand. Too much demand leads to the depletion of a resource, such as tropical hardwoods. Too little demand leads to the devaluation of the material and can result in it being cleared in order to facilitate an activity with a higher value, for example cash crops or cattle grazing.

Dr Rob Foster worked with the CNMI to develop structural solutions for super tall timber construction. Dr Foster forecasts that the next 50-100 years will see urban growth double current levels before finally plateauing. In doing so, the status quo of the construction industry will be unable to meet the required demand without irreversibly damaging the environmental health of our planet. In anticipating the future challenges to the built environment, Dr Foster sees two potential solutions to this challenge. Either we can find ways to build with natural materials in a manner that meets the current structural requirements achieved by steel and concrete or we can find ways to retrofit existing built infrastructure to adapt to future needs. Utilising engineered timber for high rise construction provides a means to meet both of these solutions. Structural timber reduces the mass of a buildings structure and can be constructed in a manner that allows for eventual deconstruction and conversion to energy.

Every act of construction is an act of destruction

Right: Bario Los Andres in Manizales, Colombia. How can bamboo remain relevant in a town where it is the traditional building material, but is now being replaced by aspirational materials such as brick and concrete.

De Karel Doorman designed by Ibelings van Tilburg Architecten in Rotterdam is a sixteen floor extension constructed on top of the 1948 Ter Meulen building. The proposal from the architects was to restore the Ter Meulen building to its original condition rather than demolishing the existing building[50]. By making use of prefabricated lightweight steel and timber construction, an additional sixteen stories were added to the existing structure and foundations. The result is a 70m high tower that builds upon existing cultural heritage and retains the original building to reduce the environmental impact of the finished product.

The development of an engineered timber industry will have its greatest impact through the substitution of steel and concrete with timber products. The current drive to develop high rise timber buildings is resulting in a number of projects globally seeking to lay claim to the title of world's tallest timber building. These project utilise a number of different construction methodology's to achieve this feat. SOM published its initial Tall Timber Report in 2013 and suggests that the answer may be buildings that utilise hybrid construction rather than striving for only timber. The report recommends utilising a concrete topping slab atop prefabricated timber panels to gain the mass, acoustic and vibration benefits of concrete whilst keeping its use to a minimum[51]. By utilising a hybrid system, material consumption of non-renewable resources can be reduced whilst also benefiting from the clear structural benefits of steel and concrete.

Concrete and steel require an upfront release of carbon that is justified by the ability to recycle or provide material durability. The application of these materials in a context where cultural appetite renders a building obsolete over a short time span means that we must challenge how and why these materials are applied. Softwood timber on the other hand, has minimal environmental impact and is capable of locking up carbon. By ensuring the material has a lifespan longer than it takes for a new tree to grow in its place, there is an overall reduction in carbon emitted. Constructing structural timber buildings in a manner that also allows for eventual deconstruction and re-use of the timber, downcycled or as a fuel source, further increases its environmental credential.

The surplus of softwood timber stocks globally forms a strong argument for increasing production of structural timber products to replace steel and concrete. However, in the case of tropical hardwood timber there is a clear deficit. As a result the use of timber products in tropical regions of the world is often not considered a sustainable solution. Bamboo with its rapid rate of growth and annual crop cycle presents a viable alternative as a substitute for tropical hardwood timber. Dr Bhavna Sharma of Bath University see's engineered bamboo as the means in which bamboo may remain relevant and also gain access to markets with high levels of regulation and no history of bamboo craft. By transforming bamboo strips into an engineered product, manufactures are able to create a structural stable material that is standardised.

Dr Kent Harries (University of Pittsburgh) and Dr David Trujillo (Coventry University) have helped set the agenda on this topic through the establishment of three symposiums hosted by the University of Pittsburgh entitled Bamboo in the Urban Environment. The declaration from the initial symposium sets out a vision for bamboo as a construction material for the 21st century. Stating that "bamboo can contribute significantly to achieving many of the social, economic and environmental objectives of the new UN Sustainable

Above: The 'Workshop' built by Frei Otto and Richard Burton for the Parnham Trust, now serves as the centrepoint of the AA's Design + Make program.

Right: Looking up at the primary arch of the Woodchip Barn at Hooke Park. The beam spans 25m and is fabricated from 20 beech forks sourced from the surrounding woodland. (Image: Valerie Bennett)

Development Goals" and that "when used sustainably in its untransformed culm-form, bamboo has a smaller environmental impact than any other conventional structural material, including timber". To achieve this, they identify that "standardisation is essential for empowering construction professionals to adopt bamboo as a mainstream building material"[52].

As a recommendation, the symposium called for participation in the development of ISO bamboo standards by supporting the newly created ISO Technical Committee (TC) 296 – Bamboo and Rattan, as well as in ISO TC 165 – Timber Structures, Working Group 12 – structural use of bamboo.

Dr Sharma has partnered with Arjan van der Vegt of MOSO Bamboo to lead ISO Technical Committee 165, working group 12's development of an ISO standard for engineered bamboo products. The development of this standard enables a level of quality control in what is still an emerging industry.

The process of standardising a material with a long history of vernacular craft but a very short application in contemporary design brings to mind Deleuze and Guattari's analogy of the artisan and the architect. "The metric plane of the architect, which is on paper and off site" is vastly different to the practice of the artisan who works in-situ, at full scale, resolving "problems by means of a real life operation"[53]. The need for two way learning in this process is critical in ensuring that knowledge which is intrinsic rather than formalised is recognised as equally important as the written output of academic organisations.

Dr Sharma voiced a similar concern stressing that the exploratory/artisanal/ making process is of just as much value as the standardisation / efficiency / best practice mindset that tends to be prioritised. Dr Sharma stressed the idea of design as a medium that transcends the boundaries of any one discipline and allows for a larger holistic perspective that creates potential for disruption of existing systems and the creation of more resilient supply chains.

The Architecture Association's Hooke Park campus provides an opportunity for exploring innovative uses of timber through the intersection of traditional and digital means of fabrication. Set amongst 150-hectares of working forest, the campus was once home to the Parnham Trust's School for Woodland Industries and contains three pioneering examples of round-wood construction: the Prototype House (1987), Workshop (1989) and Dormitory (1996) co-designed by Pritzker laureate Frei Otto and Richard Burton CBE. The workshop in particular was fabricated from stressed and exposed spruce thinning's (young saplings that are removed to allow other trees to grow), sourced directly onsite and a great example of nature working in conjunction with advanced structural design.

The AA's takeover of Hooke Park has continued a design methodology that brings together both high and low-tech solutions. Each additional structure onsite has been designed and built by students through the AA's Design + Make programmes.

Design + Make explores fabrication and design at the intersection of craft knowledge, innovative technologies and natural materials. By working at full-scale through prototypes and permanent buildings, students are able to explore experimental architecture through a process of design through making. With an emphasis on timber, students source material from the surrounding

Above: The timbrel vaults of Pines Calyx drew upon 19th construction techniques enhanced through computer modelling.

Right: Cathedral del Vi by Cesar Martinell (Image: Petra Peters)

woodlands, allowing them to experience all stages of the design and construction process.

The use of round pole timbers in construction draws upon structural principles that are very similar to that of bamboo. By utilising timber in its natural state, students are faced with the challenge of working with a non-homogenous material and so must create novel solutions to utilising this material in design. One examples is the Woodchip Barn in which students 3D scanned potential trees and created an algorithm through grasshopper to work out the optimised structural system that could be created from the forks of these trees. It is an example of how the digital can begin to assist the handmade. This process could have been achieved entirely by hand, however it would have required much more time selecting and experimenting with fitting each section, which in turn would have generated far more waste. By utilising 3D scanning and digital iteration, students are able to simulate and optimise the design prior to harvesting the material.

The intersection of traditional construction typologies with digital design can also been seen in the work of Dr Michael Rammage and Light Earth Design. Most famous for their work with South-African architect Peter Rich for the Mapungubwe Interpretation Centre, Light Earth draw upon traditional Catalan methods of vault construction, such as the work of Cesar Martinell and Lluis Muncunill.

Working with thin ceramic tiles, Dr Rammage utilises Geo Gebra software, a technology that derives its structural analysis from the hanging chain principle that Gaudi utilised so effectively for his structural vaults. The Helionix at Pines Calyx, is an example of this technology in application. Designed to be constructed from local materials and have low embodied energy, the building utilises the white chalk of the nearby Dover Cliffs to form rammed earth walls that regulate the internal air quality. Thin tile vaults support a green roof and allow light into the space via a central oculus. It is an example of traditional construction techniques being adapted to create contemporary architecture with strong environmental credentials.

Bringing together the traditional with the contemporary provides opportunity for investigating how cultural and social connection can be integrated into the design process. Expanding the scope of architecture to include agents often considered outside of the design process is an opportunity for ensuring architecture moves beyond aesthetic imperatives towards elements often considered beyond the architects control. Architecture is not a final product, rather it is the sum of the process of creation, the built form and the way it is inhabited and valued. It occupies a transient point between existence and extinction, facilitating the cohabitation of what has come before and what is still to come.

Architectural impermanence does not necessitate form that is short lived, rather it suggests a state of being where new meanings are perpetually emerging. It is a position of paradox, that is dependent upon context to determine the appropriate solution. Keeping in mind that every act of construction is an act of destruction, we must consider the way in which design incorporates social, cultural and environmental considerations alongside economic and aesthetic imperatives. The result is an architecture that is permanent enough.

8

What lessons are there?

The global population continues to grow. At the same time this population continues to develop and urbanize. Ever since ATS-3 captured the first colour image of earth from space in 1967, the modern environmental movement has stressed the notion that the Earth is a closed loop system. The resources we have available to us within this system are finite and the rate at which we are currently consuming them will see many of them run out if not within our lifetime then within that of our children and grandchildren.

The built environment plays a vital role in housing this growing urban population and responding to increasing rates of displacement, however it does not entitle it to the indiscriminate use of resources in order to meet the humanitarian imperative. Reflecting on how and why materials are utilised in construction can provide new opportunities for differing modes of practice, more in line with long term sustainability goals.

The current mantra of take-make-dispose must be redefined to acknowledge the closed loop system that we exist within. Hiroshi Ota wrote that "design is just a moment within a continual state of material flow"[54]. When we design we must take into account where materials have come from and to where they will be returned. Organisations such as the Madaster foundation are already seeking to change this paradigm. Thomas Rau, one of the founders of Madaster describes waste as material without an identity[55] and view's buildings as a depot of materials that can be catalogued to re-use, re-duce and ultimately eliminate waste in the built environment. Similarly De Groene Zaak, proposes a circular model for resource consumption that priorities prevention as the first step towards reducing consumption.

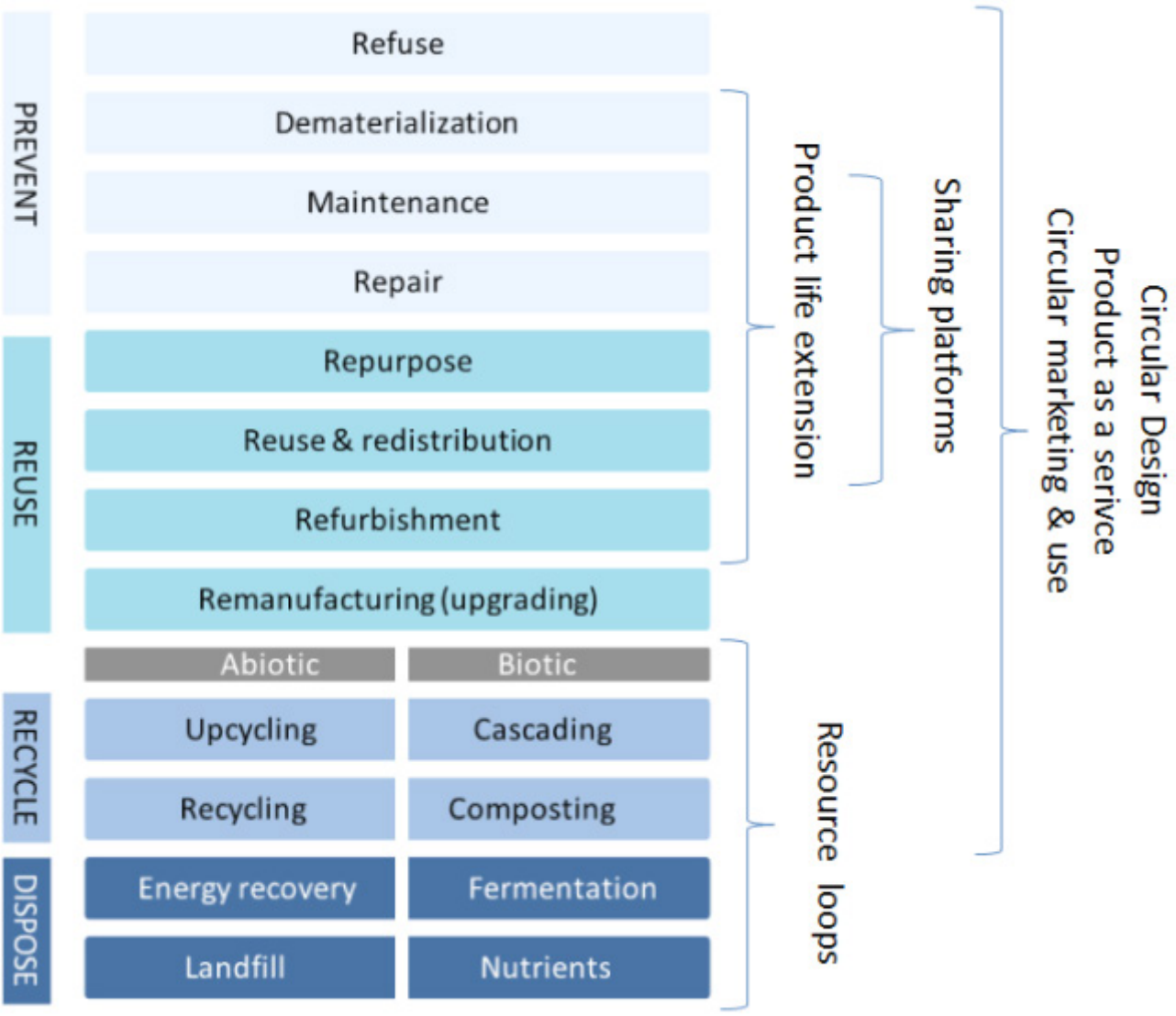
As designers we can apply this by emphasising the maintenance of existing built infrastructure and the re-purposing of buildings over the destruction and reconstruction of new built form. As Paul Pholeros used to say, we should be thinking about alterations and reductions rather than additions. There also needs to be a clear distinction made between the use of biotic and abiotic resources. Abiotic resources such as steel and concrete are incredible for what they can do structurally, however the indiscriminate use of these materials has led to unsustainable rate of consumption. There is great opportunity to further develop how biotic materials such as timber or bamboo can be utilised in construction, particularly through the development of structural laminate products. However this process must always look to balance supply and demand to ensure it does not leads to resource depletion and further environmental degradation.

Finally it is clear that material durability no longer equates to architectural permanence. Vitruvius' notion of *firmitas* can be redefined in a society defined by relativity to include social and cultural durability as key components of architectural longevity. As designers we should acknowledge that the built environment exists in various states of impermanence, which we must anticipate and design for accordingly. Ultimately it is only the destruction we cause that is permanent.

"Design is just a moment within a continual state of material flow."

- Hiroshi Ota-

Below: Ladder of Circularity
(Image: De Groene Zack)



9

Outcomes

Studio and Workshops:

1. UTS M.Arch Studio: Architecture of Impermanence

2. UNSW M.Arch Studio: Bamboo in Cambodia

3. Planting Masterclass (w/ HBC): Design for Post-Disaster Reconstruction

4. National University of Colombia – Parametric Design for Laminate Bamboo Gridshell

5. National University of Colombia - Bamboo Construction

6. Woodford Build: The Hammock Hut

7. UTAS Travel Studio: Vietnam Bamboo 1,2 + 3

8. UNSW M.Arch Studio: Housing from the Living Land

9. Planting Masterclass – Bamboo Construction

10. DICMA Trade- World Bamboo Workshop

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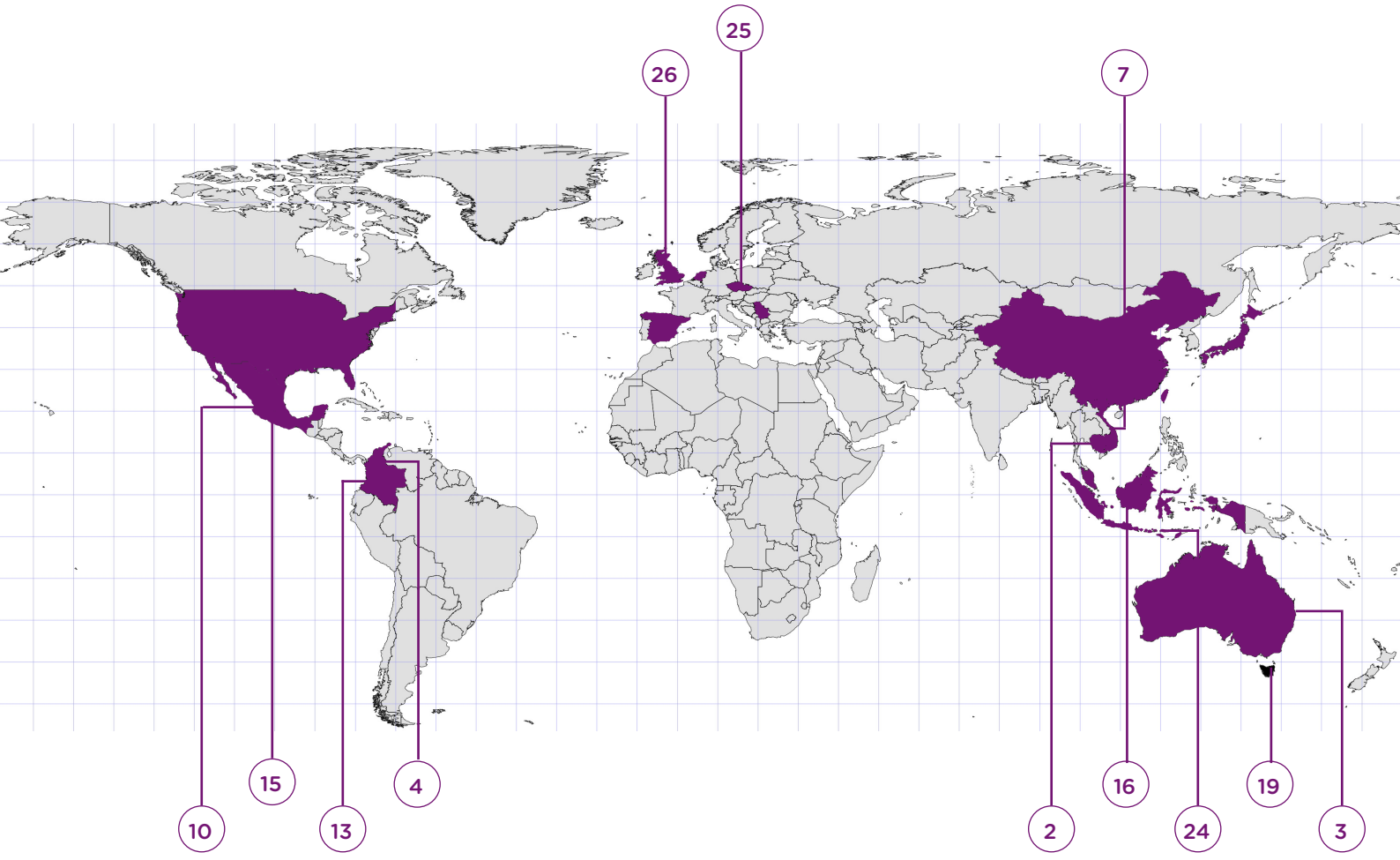
Significant Meetings

24. Kanoppi 2- Developing market based agroforestry options for small holder forestry in Indonesia (2018)

25. ISO Technical Committee 16, Working Group 12 (2017)

26. Cambridge University- Preperation for Disaster: Bamboo Shelter in Pakistan (2016)

Below: Countries visited



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Finally, I want to recognise one of the great inspirations in the development of my own career, Paul Pholeros. Paul's advice and support helped begin this journey and gave me the strength to challenge how and why we practice architecture.

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Cathy Smith	University of Newcastle
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Amanda Jaques	Woodford Folk Festival
Greg Norman	Troppo/Health Habitat
Andrea Nield	Studio Nield
Sean Anderson	MoMA
Georgia Saxelby	Diller, Scofidio + Renfro
Mimi Hoang	nArchitects
Anita Cooney	Pratt School of Design
Wang Wen Chih	Atilier WWC
Arief Rabik	Environmental Bamboo Foundation
Dave Hodgkin	Humanitarian Benchmark Consulting
Fabian Prideaux	Humanitarian Benchmark Consulting
Huong Thuc Hao	1+1>2
Vo Trong Nghia	Vo Trong Nghia Architects
Diep My Hanh	Phu An Conservation Village
Troy Roberts	RAW Impact
Dr Michael Ramage	Cambridge University
Dr Rob Foster	Cambridge University
Dr Hector Archila	Amphibia BASE
Dr Bhavna Sharma	University of Bath
Dr David Trujillo	University of Coventry
Dr Kent Harries	University of Pittsburgh
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Arjan van der Vegte	MOSO Bamboo
Carolina Salazar	National University of Colombia
Eugenia Castrillon	National University of Colombia
Ana Maria Gutierrez	Organizmo
Guillermo Mortera	Bravo Mexico
Martin Mortera	DICMA Trade
Peter van Lengen	TIBA

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About the author Jed Long

Jed Long is a co-founder of Sydney-based architecture collective Cave Urban alongside Nici Long and Juan Pablo Pinto. Cave Urban is an architectural collective that exits within the intersection of differing fields of study. Initially focusing upon the intersection of art and architecture, this process has expanded to include other areas of concern that include agroforestry and community development.

Utilizing the fluid relationship between architecture and these other fields of research, Cave Urban explores, creates and tests new structural systems outside the confines of the architectural profession, that emphasize community engagement and the continuation of vernacular tradition.

Jed sees collaboration as a key component to design, often engaging with students and volunteers to design and build works that focus upon learning through making and testing ideas in situ.

Through engagement with a number of different organizations that include the Humanitarian Bamboo Project, Taiwanese artist Wang Wen Chih, the Environmental Bamboo Foundation, Jack Thompson Foundation and various universities, Jed approaches design as a holistic practice that is built the notion of mutual knowledge.

A Churchill Fellow, World Bamboo Ambassador and an Associate of the University of Tasmania, Jed is investigating the translation of traditional vernacular construction into contemporary building practice.

12

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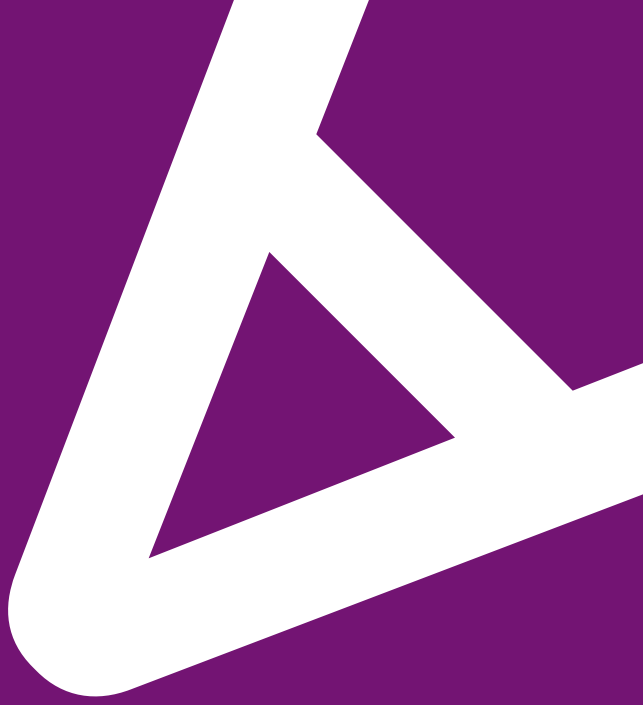

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