3.3. Business & Innovation:
Art Installations
3.5. Architecture, Engineering and Construction:
Architectural Design Construction Systems and Methods (Materials, Connections, Joinery, and Modulation).

Bamboo Art Installations and Temporary structures in Australia; Recent Works by Cave Urban

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Abstract

Through the creation of large-scale bamboo structures and art installations, Cave Urban has developed a learning platform based on research, collaboration and the sharing of knowledge. Recent works with universities, international artists and the community has resulted in a wide variety of projects that utilise raw bamboo as an ephemeral building material. From harvest to building, dismantlement and eventually breakdown, each new project serves to help dissolve the boundaries between art and architecture, while creating natural environments within the city that actively encourage community interaction.
The paper will discuss the creative process by examining a selection of Cave Urban projects from recent years including a 50m-long bamboo pavilion at the Museum of Old & New Art Contemporary Art's Dark MOFO festival in Hobart, a 24m-tall Bamboo tower in Sydney and a series of art installations and temporary structures throughout Australia.
Cave Urban is a Sydney-based collective formed in 2010 to investigate vernacular lightweight structures and their relevance to contemporary design. What began as a means for research has developed into a practice that explores the relationship between art and architecture through the use of bamboo.

Mankind has used bamboo as a building material for thousands of years. Bamboo is strong, light and fast growing. From simple shelters to large spanning bridges, the material in its most raw and unprocessed form has empowered communities all around the world to create their built environment with little resources and simple technology. In recent years, the use of bamboo has proliferated worldwide, becoming a symbol of ecology and sustainability. More and more publications and design blogs confirm bamboo's incredible diversity and burgeoning utility, from kitchen implements, furniture and textiles to large bridges and buildings.

Australia's tropical and subtropical areas grow more than 250 species of bamboo -- all but three are introduced and these natives, such as *Bambusa arnhemica*, still grow in the tropical north. While most commercial plantations sell bamboo plants in pots for ornamental use or bamboo shoots for culinary purposes in markets and restaurants, there also exists a valuable resource of high-quality bamboo suitable for construction that is currently under-utilised in Australia. It remains an untapped resource for many reasons but chief among them is the availability of cheaper Asian imports.
There is flourishing demand for a wide variety of manufactured bamboo products (household items, textiles, and gadgets among others), but the use of bamboo as a building material has been limited almost exclusively to details and terminations. Its use as a structural element has been stopped mainly by three factors:

- the lack of an Australian bamboo construction code or standard,
- the high cost of labour and
- the absence of a traditional bamboo culture.

The first step to change any of the three constraints (whether through legislative changes, technological development or knowledge transfer), is to create at the local level, a much greater interest in the material and its possibilities.

Sydney-based arts collective Cave Urban, has designed and built large-scale temporary bamboo art installations and structures in Australia for the past seven years. These works are the result of a continuous process of research and international collaboration with bamboo experts, artists and universities. Consequently their projects, of varied uses and scales, employ a combination of weaving and lashing techniques coming from different parts of the world. In an effort to increase interest and encourage the use of bamboo in Australia, Cave Urban has promoted cultural exchanges to demonstrate the possibilities of this material through the construction of large-scale temporary structures. A key influence has been the collaborations with the Taiwanese master Wang Wen-Chih, who, inspired by the basketry tradition of his hometown in the Chiayi region of Taiwan, weaves large-scale structures made entirely of bamboo -- powerful temporary spaces with a strong spiritual charge that invite and gather the community.

In contrast to permanent structures, the temporary nature of these works goes hand-in-hand with the nature of the material. The bamboo is not treated against xylophages nor it is protected from sun and rain. Instead, it is allowed to break down naturally; the ephemeral nature of bamboo can also be considered an advantage over other traditional building materials when it comes to temporary structures. When it's time to dismantle the structure, the bamboo can be reused, reincorporated into the earth or transformed into an organic by-product such as biochar which captures the carbon in its structure for millennia and can be used to improve the quality of soil, thus reducing some negative impacts on the environment.

Cave Urban´s body of work comprises a variety of large scale bamboo structures that have been built using very simple tools and tying techniques, together with a workforce that mostly had no previous experience in bamboo construction. The methodology that Cave Urban has carried out to build these projects in Australia has been developed on the fly and is a natural response to the local constraints, to be able to push the industry in a country that has ideal conditions to grow and cultivate large quantities of the most varied species of bamboo. The practice has focused on temporary structures to limit the number of standards, restrictions and costs required to build permanent structures. The construction process is in itself a learning experience, a type of workshop in which you learn by doing. This model of combining the teaching and practice of bamboo skills on the job with a community of mostly volunteers circumvents the prohibitive cost of labour, it generates a galvanising sense of pride in the group's achievements.

Most designs employ whole poles which are tied together with wire or rope, or simply woven within the structure. Whole poles are more resistant to the ravages of weather and the assembly system affords the ability to be able to disassemble installations when necessary and recover the poles for re-use. For those projects that remain intact, longevity is dependent on species selection, age of culms, time of harvest, and the level of exposure to weather. However, within a few short years hole poles tend to split and lose most of their resistance to compression, however the long fibres within help maintain a reasonable tensile strength which gives structures resistance to collapse in the face of apparent deterioration.

In well-established bamboo plantations, culms reach construction maturity in about four years. This about matches the lifespan of the temporary structures built by Cave Urban -- a significant correlation between growing and harvested materials. Structures have a life more or less as long as the time it takes to regrow the materials to replace it.

The majority of Cave Urban's works have been installed in the public domain and expressly designed to encourage community interaction. Using bamboo in the creation of public art has awakened the curiosity of many who step inside these organic structures and are transported to a natural world within the city. But working in public places is great opportunity that comes with restrictions in terms of safety, strict building time-frames and often the condition that the structure is freestanding. Overcoming these constraints often requires the use of a large amount of ballast and a certified tie-down system. Many of the latest works have light-steel frameworks and hidden dead-weight in the form of recycled building materials such as pavers or concrete blocks.

Body of Work

The following are a selection of Cave Urban's installations created in the past three years at different latitudes on the eastern edge of Australia. Spanning 2500km, the projects are located in the state capitals of Hobart, Melbourne, Sydney and at the Woodford Folk Festival in Queensland. All were conceived as temporary structures to be part of festivals, exhibitions or cultural events. The projects were financed or co-financed by public and/or private institutions. They were all built with the help of students and volunteers. The techniques used were those learned through collaboration with other artists or bamboo experts. These techniques are simple enough to be learned over the course of a couple of days. The "low-tech" character of these works facilitates the collaboration and inclusion of the community in the construction process. In this way each project becomes a school where techniques and knowledge are imparted while fostering social cohesion and a sense of community.

Near Kin Kin

A 24m Bamboo tower within the city

Towards the end of 2015, Cave Urban created a 24m tall sculpture for Sydney's Art and About Festival. The tower draws its name, inspiration and organic materials from a hillside farm near Kin Kin, Queensland – where giant stands of bamboo invoke awe in anyone who stands beneath them. The structure was temporary erected on the forecourt of Customs House Square and it has now been relocated to the Woodford Folk Festival precinct. Built primarily with bamboo and a light steel formwork, the structure was built off-site and erected overnight in the middle of Sydney's CBD. Like a bamboo skyscraper, *Near Kin Kin,* invited the viewer to step into a handmade natural environment - an escape from the surrounding concrete city. After the exhibition, the sculpture was relocated to the Woodford Folk Festival in Queensland. Against the natural environment, *Near Kin Kin* is an impressive landmark, a meeting point for visitors to raise their sights towards the blue sky.

Figure 1

Figure 2

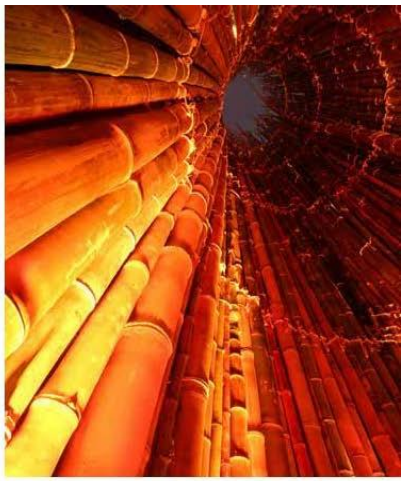
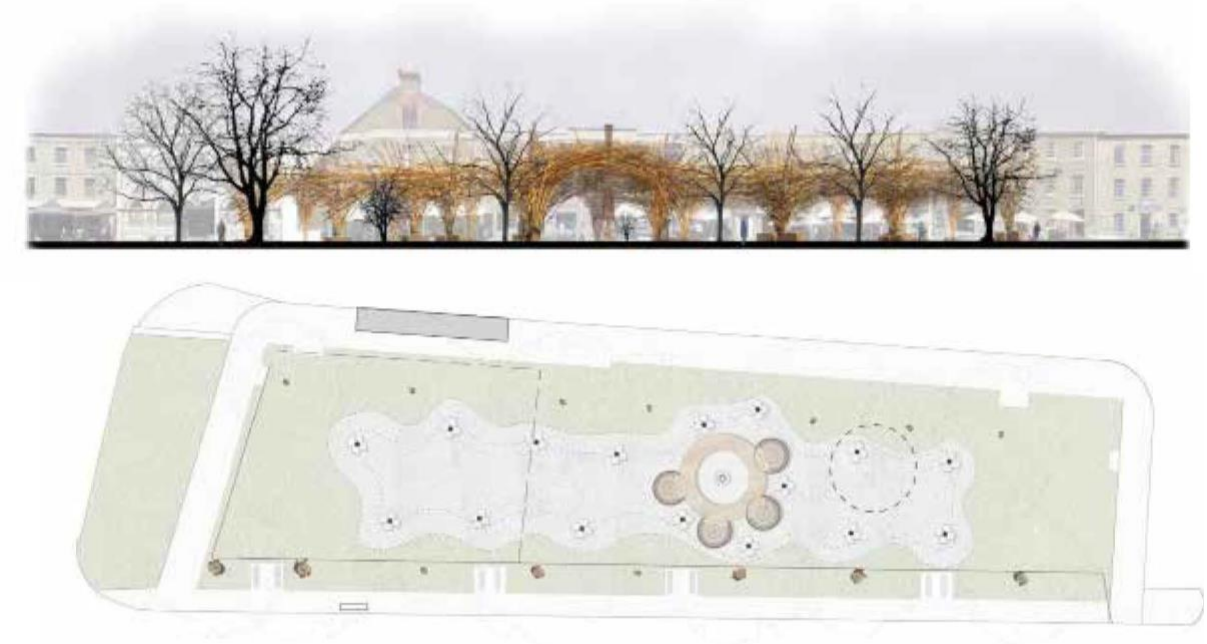


Figure 3

Figure 4

The Hot House
A 50m long Bamboo Pavilion in Hobart

Run as an intensive design studio for Masters of Architecture students at the *University of Tasmania*, the 50m long bamboo pavilion hosted advertising agency Clemenger's *Hot House* forum on education and then D*ark MOFO's Winterfeast* sponsored by Hobart's Museum of Old & New Art (MONA). The Pavilion was built by the Architecture and Art students of the *University of Tasmania* together with Cave Urban using one-and-a-half containers of Queensland-harvested bamboo poles, polyester rope and greenhouse polyethylene film. It reached a maximum height of 7m and covered an area of 10m x 50m. In the centre, two potbelly fireplaces made with recycled steel by Chilean sculptor Carolina Pinto kept the visitors warm in the middle of the Tasmanian winter. The waterproof structure coped with the harsh climate which brought winds of up to 70kph.The project, using full-scale prototyping and small-scale models to explore the possibilities of bamboo as a building material, informed the schematic design which was used for engineering and council approval. As with many Cave Urban bamboo projects, the selection of culms on-site informed the design. Working with such a wild material and assessing the different qualities of the species harvested for this project - *moso, oldhamii, aurea* - defined the outcome.
For the students it was an experience of learning by making - a process of dynamic research and experimentation in hands-on building in real time and scale.



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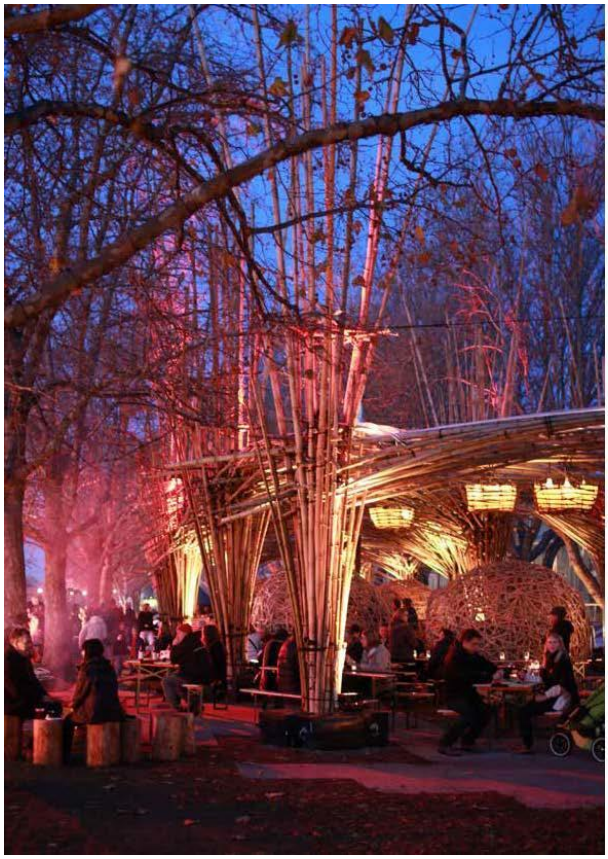

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Figure 7

Figure 8

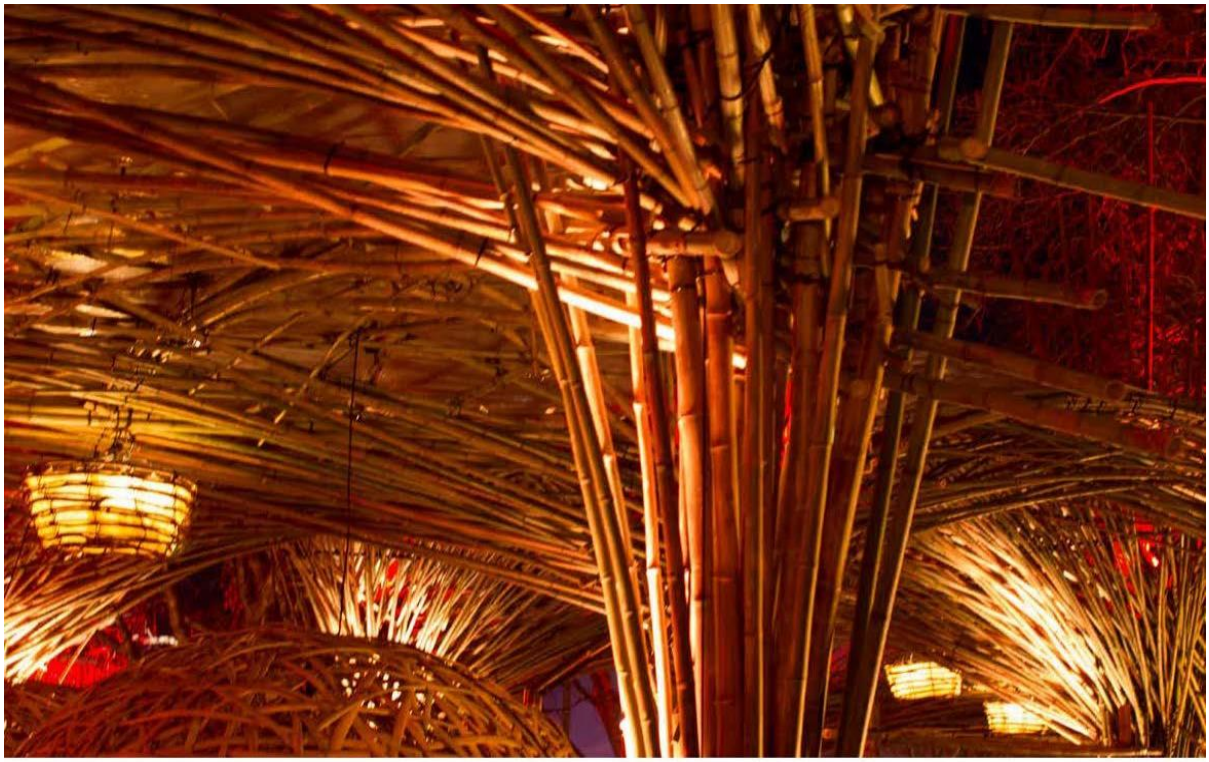

Figure 9

Figure 10

Figure 11

Quandong Dream

A collaboration with master weaver Wang Wen-Chih

Cave Urban has collaborated with a variety of international artists/experts with the aim of fostering a bamboo culture in Australia through education and cultural exchange. Run as a workshop for The Planting Festival 2016 in Queensland, Quandong Dream is a bamboo treehouse which showcases a variety of bamboo weaving techniques developed by Taiwanese artist Wang Wen-Chih.
Built with the help of 10 volunteers and using locally harvested bamboo and recycled telegraph poles, the structure was woven around a native mature Quandong tree without cutting any branches. The interior is characterised by three weaving techniques (parallel weave on the sides, random weave at the top, and a free weave tying two access ramps with the main structure). A whole pole bamboo platform gives structure and finish to the floor.

Figure 12

Figure 13

Figure 14

Regenesis
A Cocoon in the City of Melbourne

Commissioned for the 2017 ART+CLIMATE = CHANGE Festival in Melbourne, the sculpture was exhibited for a month in Acland St Plaza, St Kilda. The work - evoking a cocoon or chrysalis that has opened - was relocated to Melbourne's Gasworks Art Park for extended exhibition. Visitors are invited to climb inside the sculpture and inhabit the space.
Using 800 bamboo poles and with the help of volunteers, the 8m long structure was built on four light steel rings which allowed for a quick build and certified transport in a single piece with rated lift points.

Figure 15

Figure 16

Figure 17

The Golden Hour
A Bamboo sculpture by the sea

Exhibited at Sculpture by the Sea 2016 in Sydney, The Golden Hour was built onsite using 700 poles of locally harvested *aurea* bamboo and with the help of volunteers. Balanced at the edge of the headland overlooking iconic Bondi Beach, the 4m diameter sphere lined up with the horizon to celebrate sunrise and sunset. The sculpture invited the viewers to step inside and perceive their environment through a filter of woven bamboo.

Figure 18

Figure 19

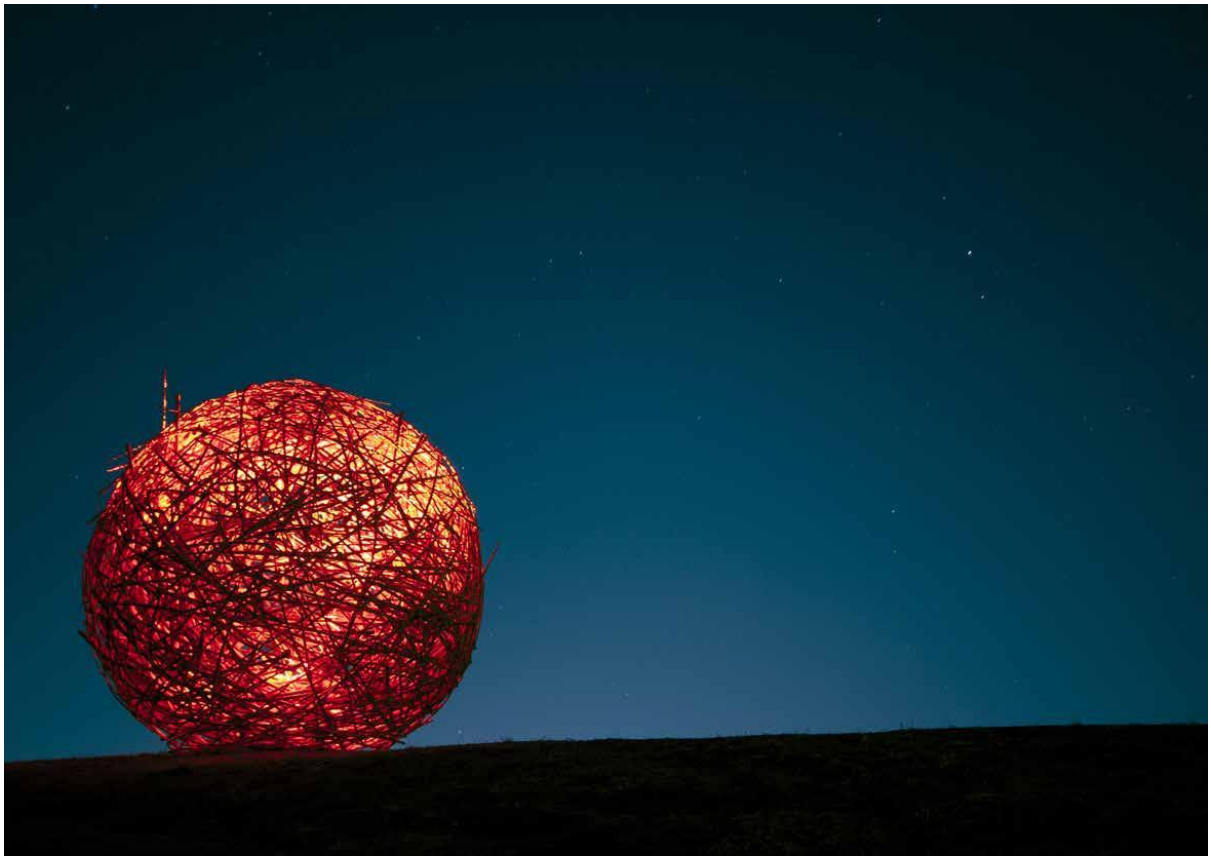

Figure 20

Banksia Tunnels

A bamboo playground in the Centennial Parklands

Within the Ian Potter Children's Wild Play Garden at the Centennial Park, Sydney, Aspect Studio invited Cave Urban to create an installation to frame a series of tunnels within a forest of native Banksia scrub. As the bamboo ages and breaks down, the Banksias will grow and follow the shape of the bamboo to create a living structure. The tunnels were built using bamboo, tree branches and wire. The green materials came from the gardens with the help of volunteers and the Parks and Gardens staff.

Figure 21

Figure 22

Figure 23

Conclusions

The construction of temporary structures and bamboo art installations have made possible the development of a new architectural language that is somewhere between art and architecture. These structures have allowed creativity to flourish in an otherwise highly regulated environment.
These works that juxtapose an interesting relationship with bamboo and its ephemeral condition. Using green bamboo causes a number of conditions that reduce its duration over time allowing its deterioration. The works presented here show that green bamboo also has certain advantages that, especially for the construction of temporary structures, it is appropriate to consider. The natural bamboo shows greater resistance and flexibility, greater resistance to fire (before it dries), on the other hand the dimensions of the bamboo are only limited by the transport and not by the capacity of the treatment plant. The costs associated with the treatment and treatment of bamboo are also reduced while eliminating the use of substances that can be toxic to health and the environment, allowing their composting or transformation into other by-products without major problems.
Attempting to make this incredible material last well beyond its normal life is a challenging undertaking in an expensive country such as Australia, so Cave Urban instead prefers to view harvested bamboo's perceived weaknesses as a strength - to showcase its qualities of phenomenal growth, strength, versatility, sustainability and beauty via the mediums of art installations and temporary structures.
Finally, the methodology that Cave Urban has used in recent years has managed to establish the constructive process as a platform for cultural exchange, education and fostering a sense of community. In this way, the greatest benefit that these projects produce is of a social nature. The opportunity to build something meaningful, large and in a matter of weeks empowers people and communities, generating strong human bonds. These experiences not only encourage the future use of bamboo, but can also be applied to many other community projects where teamwork is a powerful tool.

List of figures

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