ARCHITECTURE WITHOUT ARCHITECTS

A Thesis
Presented to
The Faculty of the Department of Architecture
Cornell University

In fulfillment
of the Requirements for the Degree of
Master of Science in Advance Architectural Design

by
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Abstract

This portfolio is a manifestation of an ongoing investigation of understanding the agency of architecture in our current built environment. Through illustrations and writings, I elaborated my research and understanding of architecture in the area of my TI (Territory of Investigation) - Architecture and Discourse. It mainly consists of two different studio explorations (ARCH 7712 - Rational Form Making) (ARCH 7113 - Universum Carrousel Journey), and elective courseworks related to my Territory of Investigations (ARCH 6308 - Shinohara Kazuo and Contemporary Arch in Japan) (ARCH 6408 - Robots, Cyborgs, and Architecture) (ARCH 6408 PhotoArch/Collective Fictions) (ARCH 6309 - Principles, Theories, and Elements in Japanese Architecture and Gardens).

In the research, I attempt to challenge the idealistic role of architects in defining the future of our built environment. With the advancement of technology, methods of building, and materials in this postmodernism era, certain changes, inventions, and evolution of styles are inevitable. The title “Architecture Without Architects” summarizes the modern trend where the essence of architecture is often neglected and overcome by aesthetic, ego, and power. A phenomenon that leads us to the question of “to what degree is the role of vernacular architecture transpiring in this 21st century, when glass and steel towers proliferate and the homogeneity of urban fabric increases?” Therefore, in this research I would like to explore how architects can adopt the essence of vernacular architecture while still maintaining the integrity and aspects of post-modern architecture. The research is concluded with comprehensive illustrations and supplemental materials of my work to support the respective investigation.
Table of Contents

Abstract 03
Research Paper (Architecture Without Architects) 06
Archive (ARCH 7712 - Rational Form Making) 12
Archive (ARCH 7113 - Universum Carousel Journey) 32
Archive (ARCH 6408 - Summer, Territory of Investigation) 48
Archive (ARCH 6308 - Contemporary Arch in Japan) 54
Archive (ARCH 6309 - Theories in Japanese Architecture) 57
Architecture Without Architects

What I have learnt about architecture these passing years has raised my curiosity and interest in the idealistic role of architects in defining the future of our society. In the 21st century, I realize the challenge we are facing is the eroding quality of our general built environment. In Hong Kong, for example, high-rises were built with minimal set-back in the city fabric, creating extreme density and causing urban congestion. For architecture to regain its foothold as a substantive medium, the general quality of the built environment needs to be raised to a much higher level.

In this technology - saturated age, when prefabrication becomes the new norm of construction, skyscrapers and high-rise buildings have become a prominent measure of modern cities. To say the least, we are confronted with the syndrome of "city anonymity". What makes a building complex in New York different from one in Shanghai, or Chicago, Hong Kong, and Tokyo? All these cities have accumulated a tremendous sprout of "concrete jungle" portraying power and capitalism, bold and conflicting to the environment. This sequence: the accumulation of modernist ideals, the imagery of our discipline's failure, and our inability to recover from such a fall, has culminated in the marginalization of our professional and cultural authority. As a consequence, we indulged ourselves in solving this self-created problem.

For architecture to regain its relevance, it must perform outside of its prescribed role by curating techniques and modalities of thought that establish extrinsic relevance in service of repositioning ourselves as authoritative guardians of the environment and culture. While many obsess over the rapid growth that leads to a monochromatic scheme of a city, an architecture which presents a new perspective on such a built environment becomes essential in a time that views the loss of identity as imminent. In response, I believe revitalizing vernacular architecture is crucial to fight the paradigm shift from local to global in the realm of architecture.

With the advancement of technology, methods of building, and materials in this postmodernism era, certain changes, inventions, and evolution of styles are inevitable. A movement that leads us to the question of "to what degree is the role of vernacular architecture transpiring in this 21st century, when glass and steel towers proliferate and the homogeneity of urban fabric increases?" Therefore, in this research I would like to explore how architects can adopt the essence of vernacular architecture while still maintaining the integrity and aspects of post-modern architecture.

In the global era, when homogenous architectural styles have infiltrated the urban fabric of cities around the world, architects ought to seek solutions to prevent this accumulation of urban concrete and the eroding culture of our society. Sendai Mediatheque, being one of the most notable architecture pieces in the 21st century, stands as an exemplary work that displays the unification of vernacular and post-modern architecture. Despite its modern look and advance physics, Sendai Mediatheque has taken inspiration from native Japanese tree, Zelkova, an ornamental tree with seemingly weaving trunks, and traditional "tree-like" structure that can be traced back to the 592-710 Asuka period in the history of Japanese architecture from Horyu-ji Temple. The columns on Sendai Mediatheque work identically with that of Horyu-ji Pagoda, with a technique called 'tuned mass damping,' where the architects let the columns (Shinbashira) move deliberately to withstand shear forces from wind and earthquake.

"Sendai Mediatheque survived a devastating magnitude 9.0 earthquake in 2011. The image indicates how Toyo Ito combined both rigid and dynamic structure to achieve optimal balance and structural efficiency, one that could withstand such natural forces. Two points to be noted here are as follow: (1) the columns start from the underground, giving a higher tolerance for the columns to shear. (2) Dynamic (higher tolerance) rectangular structure is located below the rigid (less tolerance) triangular structure, increasing the tolerance for the building to earthquake."

ARCH 7712 - Rational Form Making - Case study analysis of Sendai Mediatheque
ARCH 6309 - Principles, Theories, and Elements in Japanese Architecture and Gardens - Horyu-ji Pagoda structure analysis

[Image taken from: ai-archinect.com web-japan.org]
The research continued with an exploration in combining different, possibly contradictory, existing architecture concepts, including Sendai Mediatheque, Mannheim Multihalle, Orleans Bridge, and Millennium Dome, in order to come up with an innovative piece of architecture. It is an attempt to showcase architecture as a growing and evolving process, as we have ‘stood on the shoulders of giants’ to reach this point today. Hereby, the final outcome of the exploration was formed through one iteration after another, a methodology used to preserve fragments of architecture and move forward.

A study of House in Uehara, by Kazuo Shinohara, is crucial to understand how vernacular architecture (in Japan) evolved during the transitional era of globalization. As Japan’s most celebrated postwar architect, Kazuo Shinohara had initiated an empirical research into Japan’s contemporary vernacular architecture and the typology of private houses where he separated his findings into four different styles each with its time period. For example, House in Uehara, 1976, would fall into the ‘third style’ of his architectural language.

Van Driessche house, 1980, is a derivation of several architecture pieces one of which is Frank Lloyd Wright’s FallingWater. The impact of Scandinavian architecture was clearly visible in his architectural designs in a kind of ‘romantic modernism’, in which he established an organic connection between architecture and relief design. As a Belgian pioneer in architecture, Jos Van Driessche has established his place among the notable architects in his era.

To understand further about the application of vernacular architecture in the postmodernism setting, a research on five different exemplary houses throughout three different cultures, America, Japan, and Europe was conducted. The case studies focused on the architecture history, typology, and tradition of each respective house and how they can relate to one another. These houses were made by architects Yoshida Isoya, Kazuo Shinohara, Jos Van Driessche, and the architect of the Shaker House, pioneers of their respective era. The study began with Inomata-tei, by Yoshida Isoya, a Japanese architect and pioneer of modern ‘sukiya style’ of building, in which an affinity for natural materials and traditional construction techniques finds expression in contemporary structures. According to Yoshida Isoya, a ‘sukiya style’, although ordinarily based on handcrafting in wood, could use modern materials as long as they were used in the ‘spirit of the style’. This expression could be seen in Inomata-tei, 1967, where he altered the traditional style of Japanese architecture into a modern setting.

These studies aimed to understand the relation between the making (construction), material and detail, the meaning (context), culture, and tradition. Using this methodology is a way to preserve our history and to move forward in creating new architecture. The study continued with creating several iterations as an attempt to merge several congruent elements of those different houses together. I concluded the research and studies by showcasing transcription pieces of architecture throughout history in the form of a house, an effort to show the possibility of adopting the essence of vernacular architecture in a post-modern architecture setting.
It is very unfortunate that vernacular architecture tends to be overlooked in the era of globalization, where most architecture are bound by money and power as sole inspiration. Nowadays, we often see stylistic elements of design intentionally incorporated for aesthetic purposes which go beyond a building's functional requirements. On one hand, it allows architects to create astonishing, extravagant, sculpture-like pieces of architecture. On the other hand however, the atmosphere, the sense of place, and the essence of architecture are often neglected, leading to the diminishing quality of our built environment. To end this phenomenon, I found it necessary to analyze the context, studying the cultural, social, and artistic influences of architecture pieces before going into the drawing board. We ought to let ourselves be inspired by architectural works in the past and carry on the concept of those pieces to the current. Vernacular architecture should be the key element to our progression in this post-modern era. Hence, it is up to the new generation of architects to question the status quo.
Exterior Render
Digital media: V-ray raw render, Photoshop

Physical Model (20” x 24” x 8”)
Media: 1/16” matboard, 1/16” balsa, 1/32” wood dowel, resin
Case studies of different architectural projects
Sendai Mediatheque -
Mannheim Multihalle -
Millennium Dome -
Orleans Bridge -

Media: wood plank, 1/8" & 1/16" Balsa, 1/16" Wood dowel, threads, hook nails
In pursuit of freedom in aesthetics, the disciplines of architecture and structural design have always worked hand in hand in expanding new possibilities of form finding and space making. Rationality is at the heart of modernism’s approach and can be traced back to trajectories in structural design. The first is the gradual reduction of mass, as exemplified in the Domino House and the Maxweel language. The other is the transition from clear Euclidian geometries in spatial structures (such as the Pantheon) to a return of naturalism and free forms.

Optimization precedes superficial forms. This project highlights the collaboration between architects and structural designers in exploring new possibilities of form finding. The domed shape in this collaborative relationship has been that of structural rationalism, as expounded upon by the work of Brunelleschi and Viollet-le-Duc. The goals are to (1) explore the possibilities of close integration between structural concept and architectural design, contrary to the conventional practice of a linear progression from architect’s imagery to structural engineer’s implementation and to (2) discover the difference between geometry-based form making versus structurally-based rational form finding. Structure is not only a problem solving process but a key to new possibility in design.
Part I - Research of major paradigms of forms / structures with both historical and more recent precedents. Four case studies were selected as the basis of the project: Sendai Mediatheque, Mannheim Hall, Millennium Dome, and Ollies Bridge. The case studies were later focused into two: (1) Millennium Dome and (2) Ollies Bridge, due to their unique correlation, identical, but distinct quality in terms of concept and structural logic.

Millennium Dome (1999), designed by architect Sir Richard Rogers, consists of 12 (900 ft) inclined steel nacelles tied to the center ring with steel cables attached to 12 pulling mechanisms. The teflon-coated membrane of the dome creates an interior floor area of more than 81,000 square feet, a considerably lightweight structure to the volume it made. Key notes: (1) Each pair of pillars create a counter gravitational (force) to lift and form the dome; (2) The membrane is attached with steel cables from above and below to prevent possible up-lift wind load.

Part II - An experimental workshop, where a series of experiments through scale models to test the structural concepts were conducted. In the case of Millennium Dome, the experiments on the impact of mechanism and movement in relation to form (finding kinetics). In contrast, the conducted experiment on Ollies bridge is about tension-compression relation to maintain a respective form post.

Inspired by the kinetic movement of Millennium Dome's study model, I figured a new approach of an action-reaction mechanism. In the previous study model, the bending is caused by six strings pulling the two wooden rods in varied tension levels on 1 different segments (bending = action). In this experimental model, the bending is causing a chain reaction which allows two rigid rods to span and return (bending = action). Through this study, a reversed mechanism was discovered.
OCEANS BRIDGE

Part 1 - Research of major paradigms of form/structure with both historical and more recent precedents. Four case studies were selected as the basis for the project: Senda Medihatuque, Millennium Dome, and Orleans Bridge. The case studies were later focused into two, (1) Millennium Dome and (2) Orleans Bridge, due to their unique connection, identical, but distinct quality in terms of concept and structural logic.

Orleans Bridge (2000), designed by architect Santiago Calatrava, is an inclined (55°) arch bridge over the river Loire. Two concrete tripods of three inclined branches support the central arch span. The optimal use of support helps one observe a perfect oval on the water. The deck is asymmetrical and curved from the bottom, representing a ship hull, while the arch representing the mast of the boat. Two series of 26 cables in a reversed V-form suspend the bridge. The hangers stabilize arch and distribute the force created by the inclination, on the deck.

DECONSTRUCT / OCEANS BRIDGE

Part 2 - An experimental workshop, where a series of experiments through scale models to test the structural concepts were conducted, in the case of Millennium Dome, I experimented on the impact of mechanism and movement in relation to form bridging (tensegrity). In contrast, the experimental framework on Orleans Bridge is about tension-compression relation to maintain a respective form (tensegrity).

Derived from the Orleans Bridge's study model, this experimental model aims to use minimal contact to the ground while utilizing tension and compression to hold certain object, in this case a 6"/2" wooden rod. The bending creates a vertical force, allowing the string to lock the 6/2" wooden rod in place. The result is a simplistic structure of floating compression/tensegrity.
Iteration I

Based on previous study models, two new factors were added into consideration (scale and size). Through this iteration I discovered three things: (1) knowing the bending limit of different wooden rods; (2) experimenting on breaking the symmetry of tension-compression structure; and (3) attempting a space creation through an amalgamation of curved rods.

Iteration II

In the second iteration, I was experimenting on unifying two separated structure and further breaking the symmetry of a generic tension-compression structure. Another new element was added in this iteration (membrane). The membrane helped defining spaces better and giving volume to the structure.
SCENARIO + DETACHMENT

Iteration III

In the third iteration, I was experimenting on giving the structure a scenario (site specific). The goal is to use minimal supports from the ground to create a space, as it would be located near a lake. The spaces in this iteration are concentrated at the center. An experiment on creating a detailed form was also conducted.

LONG SPAN + EXTENSION

Iteration IV

This iteration is a revision of a part of iteration III. I decided to remove the detached form and went along with a clearer structural logic. Still following the same concept, the structure is only supported at corners (long span structure) and only using minimal components, giving a lightweight appearance.
**Iteration V**

This iteration is a development of Iteration IV. The use of two wooden rods gives a more optimal (long span) and wider support compared to its previous iteration. Similar structural concept with the Millennium Dome, the vertical rod acts as a counter balance toward the leaning rod (resembling a vertebrae of the tent).

**Iteration VI**

Exploration on tension compression from 2D to 3D. A new factor was added into consideration (deflection). Through this iteration I discovered that a gesture as simple as twisting a wooden rod would create a free-standing (tension-compression) structure. This iteration would result in a more dynamic design possibilities. Although free-standing supports are still necessary near the point of max deflection to avoid breaking.
PAVILION / CONCEPT

Emphasizing the importance of experimental explorations on new form-finding, the final outcome of the studio is the creation of a pavilion, based on the thorough studies and experiments, in Lake Tomro, Rhode, RI.

Concept & Details

A mock-up model of the pavilion. To create a space, a set of wooden rods were twisted and bent to acquire the desired volume and spans. To secure and brace the form, a larger wooden rod was added (perpendicular or adjacent, but never parallel) on top of the set and fixed with strings. A great material option for the pavilion is Guadua Bamboo, due to its high tension/bending strength and its relatively low modulus of elasticity.
ARCH 7113 - Universum Carrousel Journey
Instructor : Kana Arioka, Jan de Vylder
Work Type : First half, Group of two (In collaboration with Mitchie Qiao) (research)
: Second half, Individual (Project)
Spring 2020

Case studies of different architectural projects
- The Shaker House
- Van Driessche House
- Inomata-tei

Media:
- Micron pen
- Strathmore paper

Case studies of different architectural projects
- The Shaker House
- Van Driessche House
- Inomata-tei

Media:
- Micron pen
- Acrylic paint
- Strathmore paper
Case studies of different architectural projects
- The Shaker House
- Van Driessche House
- Inomata-tei

Media:
- 1/16" matboard
- 1/16" & 1/8" balsa
- plaster
As I ascend up the stair, toward the small aperture at the corner, I can already hear distant voices of excitement; the sound of wind and rustling leaves, birds chirping, passerby walking, the steady burble of water fountains. The landscape stares at me in the face and diminishes into the horizon.

“I always dreamed of having a window with a view. The window asks for a view don’t you think? A view of sun, a serene landscape, complete with oasis of plants, flowers, and trees. Who wouldn’t dream of such panorama in the midst of this chaotic world.”

Here is a place I called home.

What’s space without partitions? An archipelago.
There is magic in its fragrance
There is solace in its taste
And the laden moments vanish
   Somehow into space
The world becomes a lovely thing
There's beauty as you'll see
   All thanks to a sip of tea.

A place I find comfortable and adore
But I have no clue if I still have a floor
To the left of me are stacks of books
To the right, maquettes galore
A mountain of scraps lies in the corner
Under the hanging vines and bonsai
Perhaps with enough time, a week or two
I might someday find
   Beneath that pile of paper rolls and debris
That trusty key of mine.
Material (aluminum) investigation and innovation

 fabrication Methods of Aluminum:

A. Material Preparation:
Cutting:
- aluminum sheets can be formed in a dry area to avoid water staining.
- Mass-produced components can be painted in the factory using powder coatings. For non-factory application, aluminum can be coated using solvent-based paints. As compared with mill finish, or else appearance, is artificially increased. The effect is to improve the corrosion resistance and also the appearance, as compared with mill finish.
- Anodizing is a process in which the thin oxide layer, always present on an aluminum surface, is artificially increased. The effect is to improve the corrosion resistance and also the appearance, as compared with mill finish.
- Friction-grip bolting is a process in which the plates to be joined are butted together on top of a firm support bar, and are clamped together for maximum rigidity under shear loading. This method is using special high-strength bolts to transfer the load directly from the plate to the bolt, allowing the load to be transferred from bolt to bolt in a single piece.
- Riveting (out of date) should not be used in situations where they have to carry tensile loading.
- TIG (Tungsten Inert Gas) welding is widely employed, especially for heavier construction. It is a Direct Current process, and should not be used in situations where they have to carry tensile loading.
- Shearing is a process in which the plates to be joined are butted together on top of a firm support bar, and are clamped together for maximum rigidity under shear loading.
- Friction bonding is a process in which the plates to be joined are butted together on top of a firm support bar, and are clamped together for maximum rigidity under shear loading.
- As a connection technique for aluminum, adhesive bonding has features that often make it a valid alternative to bolting, riveting or welding. Adhesives used with aluminum are usually epoxy materials.

B. Environmental Facts:
- Cutting (circular saw / band saw / laser cutting)
- Friction bonding:
- Connection for maximum rigidity under shear loading.

C. As a welding process, TIG welding is widely employed, especially for heavier construction. It is a Direct Current process, and should not be used in situations where they have to carry tensile loading.

D. Friction Stir Welding:
- This process is mainly used for small welds in light gauge material, and to repair MIG welds. It is an alternative to traditional welding methods.

E. Adhesive Bonding:
- This process is mainly used for small welds in light gauge material, and to repair MIG welds. It is an alternative to traditional welding methods.

F. Protection and Finishing:
- The material finishing on surfaces finishes on aluminum is either protection or corrosion, or else appearance.

Storage:
- The material finishing on surfaces finishes on aluminum is either protection or corrosion, or else appearance.

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https://www.youtube.com/watch?v=xYkz775Yq1c
https://www.youtube.com/watch?v=7Pj5p0pQ1Nk
**MATERIAL PREPARATION**

**SELF-ASSEMBLY LAB, MIT**

**ACTIVE AUXETICS**

**PERFORATED ALUMINUM PANELS**

**THIN ALUMINUM FABRICATION**

**KINETIC ARCHITECTURE CONCEPT**

**A** = metalic strip, higher modulus elasticity

**B** = metalic strip, lower modulus elasticity

**HEAT**

**MOVEMENT**

**ASSEMBLY FINISH**

CNC ROUTER WATER JET

Laser cut mold

Band saw bender

Bolt & screw welding

Spr solid rivet

Monobolt hemlock

**FABRICATION METHODS**

Heat-sensitive aluminum strip

Two aluminum strips bonded with adhesive

Stack two aluminum strips with different elasticity

Turn the sheets into stripes.

**ALUMINUM SHEETS WITH DIFFERENT ELASTICITY**

**SHEET A**

**SHEET B**

Thin strips of aluminum arranged in different direction to create opening.

50

51
In the city, we can see the impact of the modernism of Japanese architect Hiroshi Nakamura and Tadao Ando. Both of these architects have been at the forefront of contemporary Japanese architecture, blending traditional motifs with modern materials and techniques. This blend of the old and the new is characteristic of much of contemporary Japanese architecture, where the the past is not forgotten but rather blended into the present.

For example, Tadao Ando’s Church of the Light is a testament to this blend. The church is built on the foundations of a traditional Japanese tea house, with a rectangular volume of concrete and glass that reflects the lessons of traditional Japanese architecture. The use of concrete and glass, however, is not meant to compete with the traditional materials, but rather to complement and enhance them.

In contrast, the work of Hiroshi Nakamura is marked by a more experimental approach. His Tower House, for instance, is a minimalist structure that uses concrete and glass to create a sense of space and light. The house is designed to allow natural light to penetrate the interior, creating a sense of openness and freedom.

Both of these architects have been at the forefront of contemporary Japanese architecture, blending traditional motifs with modern materials and techniques. This blend of the old and the new is characteristic of much of contemporary Japanese architecture, where the the past is not forgotten but rather blended into the present.
In a sense, the two architects have aimed to reinvent the traditional vernacular architecture in modern times. Through their uniquebiographic relationship with the master architect, Kazunari Sakamoto, and the formation of their architectural identity, they have created buildings that are not only a product of their own creative vision but also a continuation of the legacy of their mentor. Their work has been characterized by a deep understanding and respect for the traditional minka house, which they interpret and adapt to contemporary needs and contexts.

Yoshiharu Tsukamoto and Kazunari Sakamoto have a similar sense of progression in their work, both of them beginning with small openings at the bottom of the facade adjacent to the street and expanding them to the autonomy that the architecture itself maintains.

Tsukamoto's book "Graphic Anatomy", a reflection on anonymous dwellings, also reflects the same sense of progression. Tsukamoto's approach to archi
tecture has been characterized by a focus on the urban context, the concept of encasing, and the use of stairwells as a design tool.

Kazunari Sakamoto's approach has been more focused on the individuality of the building. By using thin steel plates and delicate structure, he has been able to achieve a lightness and a sense of progression in his work. The use of stairwells has been a recurring element in his projects, acting as a link between the interior and the exterior.

In terms of composition, both architects have a similar sense of progression. Tsukamoto's stairwell is portrayed in a form of vertical continuous passage, while Kazunari Sakamoto applied this idea through the voids within an encasing structure. However, the composition as a design principle owed to Kazunari Sakamoto is clearly recognizable in how Yoshiharu Tsukamoto presented the respective concept in a form of vertical continuous passage.

The architecture of both architects has been characterized by a deep understanding of the natural milieu and its expression in the built environment. The different approaches are clearly reflected in the two housing projects we've discussed—the Kumono-Nagareyama House and the House Tower. The Kumono-Nagareyama House is built slender and minimalistic, while the House Tower is built slender and minimalistic. The Kumono-Nagareyama House is a response to the site, while the House Tower is a response to the city fabrics. However, despite both being successful in applying the ideal (modern) vernacular architecture in their own interpretation, they use different approaches in terms of composition and urban context.

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House Tower, interior: https://www.flickr.com/photos/wakiiii/7651724568/in/photostream/

House Tower, exterior: https://www.flickr.com/photos/wakiiii/7651724568/in/photostream/

Kumono Nagareyama House: https://cread.jd.com/read/startRead.action?bookId=30425241&readType=1

House Tower, exterior: https://www.flickr.com/photos/wakiiii/7651724568/in/photostream/

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House Tower, exterior: https://www.flickr.com/photos/wakiiii/7651724568/in/photostream/
Comparative study of structural composition between the past and the present

Comprehensive study on Kazuo Shinohara’s four architecture styles

ARCH 6309 - Principles, Theories, and Elements in Japanese Architecture and Gardens
Instructor: Leonard Jay Mirin
Work Type: Presentation Slides
Spring 2020