SITTING PRETTY:
THE ARCHITECT &
THE CHAIR

BY SHANTA TRUSEWICH

A Research Project submitted in partial fulfilment of the requirements for the degree of Master of Architecture Professional. Unitec Institute of Technology, 2012
ABSTRACT

“...the vertical, bearing portion of furniture forms is truly the small sister of the architectural column.”

- Alvar Aalto

Throughout history great architects have proven success in the field of furniture and chair design. This research project asks why architects have pursued furniture making and design, along with asking the question:

How does the process of making furniture and applying it to architecture improve an architect’s design process, skills, values and knowledge?

The aim of this research project is to explore the relationship between furniture-making and building design. The objectives of the architecture are to address Auckland’s urban cavities, encourage occupation and use of the programme and the spaces through creating architecture as an event, and addressing the lack of opportunities to creatively ‘make’ in Auckland City.

Furniture making as part of an architectural design process is explored in the design of a transportable furniture fixing factory / community centre / exhibition space, referred to as a ‘Meuble Making Studio’. The studio is proposed to move between urban cavities in the Auckland CBD as a modular ‘semi-meuble’ structure.

The research project breaks down architecture and furniture into three categories — meuble (furniture), immeuble (architecture) and semi-meuble (built in furniture), to drive form and spatial layout by testing concepts on ‘to-scale’ furniture objects.

The architecture allows surrounding residents of the cavities to gain an appreciation for making and design, and to ameliorate or personalise furniture objects that would be otherwise discarded, and provide alternatives for the activation of the urban cavities. Once the workshop moves on, a stronger community with a newfound respect for design and craft will be able to watch over future developments in the urban cavities.

The project shows that in briefs which involve flexible and unconventional social programmes, placed on changing and temporary sites, the nature of the architect’s problem is closer to furniture making than to designing buildings.

---

TABLE OF CONTENTS

1

3 .......... ABSTRACT
7 .......... PREFACE & ACKNOWLEDGEMENTS

2

9 .......... DEFINITIONS
10 .......... INTRODUCTION
13 .......... BUILDING PROGRAMME

14 .......... PROJECT DEFINITION

15 .......... INTRODUCTION
17 .......... ARCHITECTURE AS MASS OR SPACE & HOW FURNITURE FITS
20 .......... ARCHITECTURAL UTILISATION OF THE MEUBLE
22 .......... ARCHITECTURAL UTILISATION OF THE SEMI-MEUBLE
25 .......... TECHNOLOGY AND THE DESIGN PROCESS
29 .......... CRITICAL REVIEW OF CURRENT PRACTICE
31 .......... CONCLUSION

32 .... PROJECT DEVELOPMENT - DESIGN AND RESEARCH

33 .......... DESIGN PROCESS
34 .......... RESEARCH METHODS
35 .......... SITE SELECTION
39 .......... SITE ANALYSIS AND DESCRIPTION
43 .......... CONCEPT ONE: BLANKET CHAIR BUILDING
50 .......... CONCEPT TWO: TEA CHAIR BUILDING
54 .......... COMBINED CONCEPT: MEUBLE MAKING STUDIO
62 .......... DEVELOPED DESIGN
72 .......... DETAILED DESIGN
# Table of Contents

## 5

84 ........ CONCLUSION
88 ........ BIBLIOGRAPHY
92 ........ LIST OF FIGURES

## 6

96 ........ APPENDICES
97 ........ ONE - TRANSFORMABLE AND MOBILE BUILDINGS
100 ........ TWO - SOCIAL & ENVIRONMENTAL SUSTAINABILITY
102 ........ THREE - THE MAKING PROCESS PHOTOGRAPHS
104 ........ FOUR - SITE PHOTOGRAPHS
107 ........ FIVE - NOISE ISSUES
109 ........ SIX - SITE HISTORY, CONTEXT & FUTURE
112 ........ SEVEN - DEVELOPED DESIGN: ROOF STRUCTURE
115 ........ EIGHT - DESIGN PROCESS: PROGRAMME DETAILING
I would like to thank the following, in no particular order, for their help and advice throughout the process of this project and the course of my degree. It most definitely would not have been possible without their encouragement and support. Thanks guys!

My supervisors, Dushko Bogunovich and Michael Austin; all the help and support from David Chaplin; Max Hynds for his help with services; Thom and Graham for their help and patience in the workshop; Brendan for his help in the library; everyone who came and participated in my crits, from tutors to other students; the Unitec Fellowship Scholarship Department for sponsorship; my very patient and amazing friends (especially Liz), my uni friends who I couldn’t have made it through all the all-nighters without; those who helped out by posing in photos; my family and part time proofreaders Kenah, Maddy, Rowen, Fraser & Nana, and my mother and father, Sandy Thompson and Bill Trusewich.
DEFINITIONS

Architect-designer – An architect that designs and/or makes his or her own furniture, whether for a specific building or for mass production.

Immeuble (French) - Categories of a building that are fixed and read as architecture. For example columns, walls, or floors. (See section ‘architecture as space or mass; and how furniture fits’)

Semi- Meuble - Categories of a building that are unclear as either architecture or furniture. For example, built in chairs or cabinets. (See section ‘architecture as space or mass; and how furniture fits’)

Meuble (French)- Objects which are clearly delineated from architecture as furniture. For example free standing chairs or tables. (See section ‘architecture as space or mass; and how furniture fits’)

Terrain Vague (French) - Sites that are unclear in purpose or use; often abandoned or unkempt. For example spaces around motorways. (See section ‘Site Analysis’)

Upcycle - To recycle an existing material or object and make it more valuable than its previous state.

Tetrahedron - A polyhedron composed of four triangular faces, of which three meet at each vertex.

Urban Cavity - an empty lot in a city that is surrounded by built structure. Also referred to as ‘missing teeth’.
“...It is quite impossible to consider the building as one thing and its furnishings another... in the spirit in which these buildings are conceived, these are all one thing, to be foreseen and provided for in the nature of the structure.”

-Frank Lloyd Wright

Background

Comparing furniture that an architect has made to their architecture enables us to determine more about their design ethos. Translating ideas into a different medium and scale demands refinement. Chair and furniture making provides an architect with a different paradigm in which to test ideas, learn useful practical skills and gain new perspectives on philosophical values. Furniture can be seen as a “microcosm of the world of design,” 3 that lets us compare and analyse design in terms of scale.

An architect’s choices regarding furniture layout also makes for compelling examination. Furniture, and its relationship to architecture, can be utilised to change a spatial construct entirely. This was explored differently throughout history, first designing furniture to emphasise mass of architecture, then to emphasise space.

Research Project Question

This research project asks why many architects have pursued furniture making and design, along with asking: How does the process of making furniture and applying it to architecture improve an architect’s design process, skills, values and knowledge?

Aims and Objectives

The aim of this research project was to explore the relationship between furniture-making and architecture designing. This design process was tested on the architecture programme of a nomadic furniture making workshop / community hub / exhibition space.

The first objective of the programme was to investigate and analyse urban cavities - the vacant sites into which the building will temporarily ‘settle in’ around Auckland. The second objective was to research construction methods, to inform the structure and its programmatic needs, informed by my own furniture making research process. The third objective was to explore the occupancy of the site, focusing on people using it, how the workshop tools occupy the space, and how the building occupies the site spatially.

The workshop technicians who live in the structure will hold workshops on how to ‘upcycle’

---

3 Deyan Sudjic, “Deyan Sudjic,” in 100 Chairs in 100 Days its 100 Ways, 33-38 (Unknown City: Dent-De-Leone, 2007), 34.
mass-produced furniture pieces or materials that would otherwise end up in a landfill. The local community plays a large part in the life of the architecture as they are needed to help assemble and occupy it, creating social capital enabled by architecture.

The architecture will support the hosting of a number of community events and services, such as lectures, selling furniture, screenings of design movies, and exhibitions. It will promote community discourse on design, craftsmanship, architecture, urban planning, and environmental/social sustainability. After a short time the building and technicians will move on, leaving the urban cavities’ development watched over by a tighter-knit community with a new found respect for design and making.

As an emerging architect, the skills, values and knowledge I gained through making furniture have informed the design described above, as well as having a long term effect on my practice of architecture. Throughout the design research notions of scale, material, detailing, form, construction, structure, services, colour, and spatial relationships, have been explored. These issues are relevant to both architecture and furniture making, allowing for critical analysis of parallels between the two.

As well as making chairs, the design has been interrogated through hand drawing, Photoshop collage, CAD (Computer Aided Drawing), physical modelling, consultation with supervisors, specialists and fellow students. Ongoing reflection and evaluation of progress, solutions and alternatives were provided through ongoing crit presentations with tutors, professionals and fellow students.

How my own skills, knowledge and values have changed by utilising furniture making as a design process is assessed at the end of this document. It is hoped that through this project, architects and the community will recognise the benefits of making, community involvement in design, and that practicing architecture has much more to offer than just making plans and paper models.
The finished structure will be used as a “Meuble Making Studio”, which is a travelling woodwork and metal workshop. It allows neighbourhoods to gather and create social capital through the process of design and making. It also is a display space for furniture crafted in the space, or industrial design exhibitions. A list of uses catered for are:

- Facilities for the public to make or fix furniture or small projects, assisted by the workshop technicians
- Screening of films, namely design documentaries or ‘how-to’ guides
- Hosted workshop evenings, in which specific skills are taught
- Temporary housing for the workshop’s technicians
- Lectures by people involved with the design, crafting or making industries
- Furniture exhibitions
- Facilities to sell furniture made in the workshops
PROJECT DEFINITION

EXISTING PRECEDENTS, HISTORY, & THEORIES

Fig 3 - Ray and Charles Eames arranging furniture in a model
INTRODUCTION

It is hard to find a well-known architect who has not designed a chair.

Along with practicing painting, sculpture, landscape design and industrial design, many architects have succeeded in the design of furniture and chairs. Fig. 3.1 details only a small selection of well-known objects designed by architects.

This section analyses past architect-designer’s bodies of work, the relationship between their furniture and architecture, and how they designed their architecture and furniture. This section is broken down into the following topics:

The history of spatial arrangement of furniture, defining the types of furniture that architects have designed.

How technology has influenced the relationship between furniture and architecture and design processes;

And a critical review of current practice.

Also analysed throughout all sections is individual architect’s design processes for furniture and architecture, and how they incorporate making. Throughout the sections are comparisons between relevant architect’s furniture and architecture.
MEUBLE FURNITURE DESIGNED BY ARCHITECTS

Fig. 3.1 ‘Meuble’ chairs and furniture designed by architects, all featured in the Vitra Design Museum (except Hadid’s Serif Chair)
Furniture’s placement within architecture exemplifies an architect’s skills and knowledge towards control of space and mass. This section covers the history of architect’s utilisation of furniture, and sub-sections analysing the ‘meuble’, and the ‘semi-meuble’, and how they can be utilised within architecture. It can be utilised to create defined spaces within architecture that are not formed by architectural elements, like walls or floors. This section gives a short history of architecture as mass, and the new architectural medium that developed as architecture was considered a sum of space. This section defines this element and those that support it, the ‘meuble’, ‘semi-meuble’ and ‘immeuble’.

Pre-modernist architect-designed furniture was for specific spaces, and emphasised the mass and weight of the building. William Kent (1684-1748) is considered the first architect to design furniture specifically for his architecture, and his design process involved a close relationship with skilled craftsmen (rather than making it himself). Kent constructed heavy, ornately carved marble and mahogany chairs and tables, upholstered with opulent fabrics. His furniture was arranged between columns or pressed against walls in large empty spaces, as if the walls contained forces of magnetism the furniture was attracted to. It is said that the objects cannot be appreciated outside of their context, as they are so much a part of their architectural setting. Later, furniture designer turned architect Robert Adam (1748-1792) was very definite about placing his furniture against walls and in corners, emphasizing a feeling of heaviness and solidity. However, Adam’s furniture is slimmer and more streamlined than most furniture at the time, painted in lighter pastel colours, signalling a move towards ‘lighter’ objects. Pre-modernist furniture was utilised to enforce the mass of architecture, leaving the central space as empty as possible.

Architecture as spatial volumes was first argued by the Prairie School, consisting of several Chicago based architect-designers including Frank Lloyd Wright (1867-1959) and George W. Maher (1864-1926). Wright and Maher looked to do something ‘new’ with furniture and architecture. The School argued that architecture is not the sum of its form and mass but instead a composition of space, thus affecting the way furniture ‘fit’ into architecture. By emphasising architecture as space contained, architect designed furniture no longer emphasised the mass of the architecture, therefore creating furnishing that interacted with the architecture and furnishing that did not ‘bother’ it. Furniture that interacted with architecture was a new medium. In French, ‘immeuble’ (or immobile) translates to English ‘building’, and ‘meuble’ translates to ‘furniture’. Thus, the proposed three categories of architect-designed furniture are:

5 Ibid, 14.
6 Ibid, 90.
1. The Meuble (Mobile)

Objects which are of lighter weight and often sculptural in form. These objects are more temporary in nature, as they can be moved and exchanged. There are different scales of space control within the meuble, illustrated in section ‘Architectural Utilisation of the Meuble’.

Examples include freestanding and mobile chairs, tables, or beds.

2. The Immeuble (Immobile)

Architectural elements which are permanent and are part of the overall built environment. These are fixtures that are traditionally considered architecture. Examples include walls, floors, or columns.

3. The Semi-Meuble (Semi-Mobile)

Semi-meuble furniture can be used to blur the lines between furniture and architecture, as well as blurring lines between architectural elements, such as wall to floor. As objects, they are too built in and architectural for most furniture and industrial designers, becoming the design domain for architects. Wright, and those who followed, designed the semi-meuble that lies between. Semi-meuble is furniture built into architecture that is not architecture but also does not ‘furnish’ the space. This can consist of parts such as drawers or modular units that are meuble, but as a whole the objects are fixed elements. This is further detailed in section ‘Architectural Utilisation of the Semi-Meuble’. Examples include built in cabinets, kitchens, or seating units.

Le Corbusier (1887-1965) referred to similar categories as the ‘Divided Domestic Equipment’; he referred to semi-meuble as ‘built-in storage components’ called ‘casiers’; and categorised the meuble as ‘equipment’. If French to English translation is served by its etymologic connotations, ‘equipment’ can relate to his theory of design being machines for living. In this example, being ‘equipment for sitting in’. Adolf Loos agreed with Le Corbusier’s theory of the casier (semi-meuble), and equipment (meuble), but believed existing meuble chairs were already well designed and architects should concern themselves with the semi-meuble. When considering all meuble objects however, it is not realistic to consider them all ‘machines for sitting’, or machines for anything specific, especially in a contemporary context. Therefore the term ‘equipment’ is not deemed appropriate in this analysis, and instead substituted by meuble. Semi-meuble is substituted for ‘casier’ as it covers all built in furniture, not just storage units.


Ibid, 37.
The meuble, semi meuble and immeuble utilised in Wright’s Fallingwater House is divided in this diagram.

Wright utilises immeuble walls, floor and a ceiling. There is a semi-meuble built-in couch and storage, and meuble squabs and chairs. Wright’s meuble furniture pieces are less successful in this example as the squabs hug the ground, appearing heavy and fixed. They do not allow space to flow around them, and fail to completely create a space inside of them.
ARCHITECTURAL UTILISATION OF THE MEUBLE

To further clarify the control that meuble can have in architecture one should consider a hierarchy of mobility and ability to control space. Fig. 3.4 categorises the extent to which meuble objects are able to contain space.

Wright often used meuble furniture of categories C-D as ‘space makers’. Examples include high backed dining chairs around tables that create an intimate dining experience, for example the table setting at his Lovness Studio, Minnesota. Wright’s meuble objects are often less successful ergonomically, formally and aesthetically pleasing than his semi-meuble. Perhaps this is because Wright’s category C and D meuble are heavy looking and often low to the ground. This prevents space from flowing through them like category B objects do, making them similar to neo-classical in the way they emphasise mass. This development into A and B category meuble design was not fully explored until the modernist period.

Philip Jonson said of Ludwig Mies van der Rohe’s (1886-1969) arrangement of meuble that “Mies gives as much thought to placing chairs in room as other architects do to placing buildings around a square.” The Barcelona Chair (1929) was designed for the Barcelona Pavilion in 1929 with designer Lily Reich (1885-1947).

The category C meuble Barcelona chairs could be perceived as ‘modern thrones’. Two are arranged in the Pavilion to look outwards in parallel with each other, with only ottomans otherwise in attendance. The arrangement suggests the sitter looks at the architecture instead of at the other occupant, emphasising it as a place of contemplation.

Le Corbusier argued meuble arrangement was very much the architects domain, that “the sphere of architecture embraces every detail of household furnishing, the street as well as the house, and a wider world still beyond both.” This theory is evident in his design work, ranging from category A meuble objects to entire cities.

9 Page, Furniture Designed by Architects, 178.
10 Ibid, 184.
11 Le Corbusier originally specified Michael Thonet’s meuble type B or C bentwood chairs for his buildings, before hiring designers Charlotte Perriand and Eileen Grey to design his studio’s furniture. As a design process, Perriand utilised making as an integral part of designing, constructing her own to-scale prototypes for Le Corbusier’s chairs. (Charlotte Perriand et al., Charlotte Perriand : an art of living)
MEUBLE FURNITURE MICRO-CATEGORIES

Meuble Type A
- BKF Hardoy Chair
  - Grupo Austral
  - 1938
- Fully Meuble: Collapses to a much smaller width or length than at full capable use, can be moved easily without much effort. Can be stored away in semi-meuble components, such as closets or cupboards.

Meuble Type B
- Panton Chair
  - Vernor Panton
  - 1957-67
- Stacks easily, can be moved with slight effort. Can perhaps be stored in a semi-meuble unit but not necessarily. Other examples include Charles and Ray Eames’ Children’s Chair.

Meuble Type C
- B3 Wassily Chair
  - Marcel Breur
  - 1925
- Cannot be stacked, are their own units and inhabit space as such. Can range from dining chairs to waiting room chairs. Can be moved by one person, ranging in effort. Other examples include Robin Day’s Hille Polypropylene Armchair and Frank Lloyd Wright’s Barrell Chair.

Meuble Type D
- Lounge Chair and Ottoman
  - Ray and Charles Eames
  - 1956
- Is not easily moved by one person, is often quite large and storage is quite difficult. Commands presence, examples include large living room chairs and thrones. Can also be constructed of different units, making the chair a type D rather than C because of unease of movement, such as other example, Barcelona Chair and Ottoman.
In these first examples of semi-meuble, meuble furniture is still needed to make the concepts usable. The first semi-meuble featured is also a translation of meuble ideals; Wright’s example of the library desk at Fallingwater in this section is the first example of semi-meuble that was directly influenced by immeuble ideas. Thus this section details the interaction between semi-meuble with the meuble and immeuble.

Rudolf Micheal Schindler’s (1887-1953) semi-meuble furniture took cues from Wright’s work, but was used to blend wall and floor and stair planes together in a folding motion. Schindler believed architecture was about flow of the “raw material”

12 space, helped by his utilisation of semi-meuble. He argued;

“...The furniture which is stationary (beds, etc) [the semi-meuble] become part of the weave until it is impossible to tell where the house ends and the furniture begins. The few pieces which are necessarily movable (chairs, etc) [the meuble] become so in an accentuating degree. Moving, they are unfit to define the space conception and must therefore be eliminated architecturally for the

sake of clarity. They are either folded up and stored away [becoming category A meuble] or made transparent to become inconspicuous. This is the real meaning of the metal chair. Its essence is its transparency...”

Essentially, meuble type A furniture is unable to control space. However, by eliminating meuble type B-D, and substituting it with semi-meuble and type A, one is able to allow space to flow freely through architectural voids. The semi-meuble is used to control space by blending mass in Schindler’s work. This contradicts Wright’s use of type B-D meuble, where individual objects were combined in forms to create spaces. Schindler’s description of a ‘weave’ of semi-meuble illustrates how one can utilise the semi-meuble to blur lines between architectural junctions, such as wall to floor, to ceiling. The semi-meuble Schindler Unit, built in 1931, “stops leaning against the wall and tries to merge with the floor”... “giving the furniture the character of floor terraces.”

Fig. 3.5 of Schindler’s Lovell Beach House demonstrates the notable absence of any meuble furniture, whilst still being a livable and comfortable space. The built in semi-meuble sofa is framed by a storage shelf to the left, and is set very low to the floor. It connects the floor and wall junctions. To the right hand side, the sofa becomes a part of the staircase, which becomes a part of the fireplace. This is a beautiful example of semi-meuble furniture/architecture, and the way it can “weave”. Perhaps the success of the semi-meuble in the house is the typology of the building as a beach house, so it can therefore be more informal.

Gerrit Rietveld’s (1888–1964) Red and Blue Chairs (Fig. 3.6) allow space to flow freely through them making a category B meuble. His understanding of material as planes rather

---

13 Page, Furniture Designed by Architects, 130.
14 Ibid, 131.
than mass is evident in the chair, which sits between a meuble type B or C chair. His Red and Blue chair resulted in commission for the quite semi-meuble Schroder House (Fig. 3.7), which directly mimics the openness, abstract and planar qualities of the chair. Schroder House is more flexible and kinetic however; making it semi-meuble. Wall planes move to recreate spaces for different purposes, leaving a some what free and open plan. Reitveld’s architecture imitates the most successful elements of his furniture.

Furniture in Wright’s work includes long semi-meuble rectangular tabletops extending far beyond their supports, echoing Prairie House roof forms. Wright described semi-meuble furniture as that “which will not look like an apparatus but instead be seen as a gracious feature of its environment which can only be the building itself”\textsuperscript{15}. This notion can be applied to meuble but is also exemplified in the library desk at Fallingwater, shown in fig. 3.8.

The exterior form of Fallingwater translates into the semi-meuble desk built inside. The analysis above illustrates the formal cues Wright translated from the immeuble to a smaller semi-meuble scale, somewhat ignoring the meuble chair as Loo’s suggested. A large stone anchor holding horizontal planes in place, a shadow under the lowest curved plane enables both an appearance of floating and lightness even though they seem to be the heaviest. The step back of the three planes is comparable between the two, as is the placement of the vertical lines in the centre of those planes, with the exception of the stone anchor. Semi-meuble furniture can be designed by an architect like architecture on a smaller scale, in the way that it has to take the context into consideration much more than a meuble object.

Meuble and semi-meuble furniture provide architects with tools to enhance and create space even further than with only meuble. They are simply architecture at different scales. It is important to recognise that if we do not dictate to some extent how the semi-meuble is to create spaces within our spaces, meuble furniture may contradict our architectural intentions. Semi-meuble is not only an opportunity to ensure our ideas remain whole, but also can be used to enhance the spaces we have created with the immeuble. My own architecture from this process will utilise the semi meuble to blur lines between architecture and furniture, creating dynamic and efficient spaces.

\textsuperscript{15} Ibid, 101.
Findings at the smaller scale of meuble can result in skills and knowledge that can be applied at an immeuble scale. Architects who make furniture often are often influenced by testing and developing technology. The following architects work was influenced by their fascination with technology at the time, and its capabilities.

**Eero Saarinen (1910-1961) : Scale and Technology**

Eero Saarinen believed scaling up meuble would result in technological solutions for the immeuble. In 1958 he declared the most important thing he had learnt from Eliel Saarinen:

“In any design problem one should seek the solution in terms of the next largest thing. If the problem is an ashtray, then the way it relates to a table will influence its design. If the problem is a chair, then its solution must be found in the way it relates to the room cube. If it is a building, the townscape will affect the solution.”

Saarinen’s statement disregards that perhaps design by translation of scale could by the informing the ‘next smallest thing’, by researching technology. This research project assumes that design is a cyclical process in which all scales can influence each other equally — from the meuble, to semi-meuble, to immeuble, to urban design. Technology tested at a meuble scale can just as easily influence the immeuble.

Eero Saarinen believed technology was the key to creating meuble. He asked; “how do you best relate the object to the box?”... “Somehow technology and tastes have shifted. New materials and techniques have given us great opportunities with structural shells of plywood, plastic and metal.” If Saarinen was correct in assuming that technology will make our objects lighter and more meuble, one wonders what it could mean for current practice. One could utilise modern technology such as 3D printing to make objects that defy spatial interruption even further.

---

16 Ibid, 204.  
17 Ibid, 203.
At the Bauhaus, Walter Gropius insisted students complete workshop training before admittance to the architecture programme. Through steel technology, structure became expressed, rather than hidden, at all scales. Mass production was for the first time also considered in both furniture and architecture. Marcel Breuer joined the Bauhaus in 1920, first as a student, then master, then as the head of the carpentry and furniture department.

Breuer’s immeuble and meuble was heavily technology driven. Breuer said of tubular steel in 1927 “…a frequent criticism of steel furniture, is it is cold, clinical, reminiscent of an operating theatre. But these are concepts which flourish from one day to the next. They are the product of habit, soon destroyed by another habit.” This re-contextualising of material is possible because of technology. Breuer designed the meuble prior to designing architecture in his career, testing out technology first. He argued that “the stresses on a chair are heavier than those on a factory floor,” explaining that making chairs is no less difficult than buildings; scale does not have bearing on ease of design.

Breuer’s first steel tubular chair, the Wassily B3 Chair, was built in 1925. The structural framework of the B3 chair is expressed as cold, hard, tubular steel, while the seat which is to
come into human contact is of soft leather. Space flows through the meuble category C chair, making occupants look as if they are sitting on air. Bent steel technology allowed for space to flow through furniture much more than dense timber or marble furniture. A collapsing, folding version of the chair was also developed, pushing it into the category A of meuble.

**Alvar Aalto (1898-1976) : Mass production and craftsman communication**

Alvar Aalto’s Paimo chair was developed at the same time as the Paimo Sanatorium, but not specifically for the building. The chair is a curved ribbon of bent plywood, curling at each end, lying suspended between two thin undulating plywood arm rests that run to the ground to also become supports, then arching back up again. Aalto’s design process was a collaborative effort — utilising the design skills of Aino Aalto and Eliisa Aalto, both architects who also designed furniture, and whom are often omitted from the object’s biographies.

Like Breur’s work with tubular steel, Aalto’s meuble made of birch plywood tested technology before immeuble application. Like the crafts-person and designer relationship Wright cultivated, Aalto’s work was completed with the help of furniture manufacturer Otto Korhonen. The two developed systems for bending timber by back sawing it, rather than steaming or by closed form. Mass production was limited; at that time in Finland the small economy meant limited runs of 500 or so of each chair was possible. This meant higher quality control and craftsmanship. This also meant some of Aalto’s furniture was specifically designed for certain buildings, but could be used again in others. However, Rietveld also experimented with tubular steel in the 1920s and bent plywood in 1927 well before Bruer and Aalto’s achievements. Reitveld utilised technology not only as a starting point for design, but had the skill to test conceptual thinking with technology.

**Charles Eames (1907-1978) and Ray Eames (1912–1988)**

The Eames’ experimented and tested technology the most amongst architect-designers. They worked with bent plywood machines, mass produced object and plastic and fibreglass molding. The Eames house in California is possibly the most successful scale translation of meuble and it’s technology use into architecture — it is the only example of meuble immeuble (however it technically does not move). The Eames’ used everyday mass produced industrial materials, first tested in their workshops on smaller scale objects, to create a work of architecture. Perhaps this indicates all work from the machine age on is a sort of adaptive reuse; we are bombarded with mass produced parts, for example doors or windows, and

---

22 Ibid, 199.
23 Ibid, 167.
must rearrange them in a poetic way. It is how we juxtapose those techniques that make architecture.

Figs. 3.11 and 3.12 show the translation of the Eames’ ideas into different scales. They recreated colour, form, material and proportions at a much larger scale. Both the building and the cabinet are also semi-meuble; the placement on the site up against the bank and the cabinet’s pressing against the wall, as well as its architectural lines and material, creates almost a semi-meuble looking meuble object. The building seams the ground plane with the hill plane, and is realized as a unit of opens and closes, of semi-meuble drawers and cupboards all at an architecture sized scale. In this instance this building is the most relevant architecture precedent to this research project; a direct translation of experimentation in meuble, semi-meuble and immeuble played with continuously at all scales.

Collaborative Design Processes

The collaborative design processes of architects when designing chairs reveal a number of issues. Albert Pfeiffer, Vice President of Design and Management at Knoll, notes, “Mies did not fully develop any contemporary furniture successfully before or after his collaboration with Reich.” Much like Le Corbusier and Perriand’s work, the female designer was often not given credit for her contribution to the design process. At the beginning of the Eames’ career credit was often given to Charles; it was not until later in their careers that Ray began to receive credit. Aino Aalto, Charlotte Perriand, Lily Reich, Eileen Gray, and more, some of whom have faded into obscurity while their male partners in design have become famous in canonised history for with the coauthored works. Wright’s design process utilized the skills of relatively unknown cabinet maker, John A. Ayers, out-sourcing the making part of his design process. Ayers utilised machinery but finished Wright’s objects by hand. Therefore, in Wright’s design process, forming a relationship with a crafts-person was supplemented for a lack of ability, or desire, to ‘make’ as a part of designing.

25 Page, Furniture Designed by Architects, 103.
This section describes current thinking on architect designed meuble and also outlines architect and artist Worapong Manupipatpong exploration of the meuble and immeuble link. The Furniture + Architecture edition of Architectural Design was published in 2002, outlining the issues surrounding furniture designed by architects. Editor Edwin Heathcote states that current meuble made by architects promotes interest in both architecture and architects (meuble can be mass produced, rather than immeuble buildings which must be visited to be experienced), as well as the furniture evolving into cult art pieces. It seems as if in current practice, architects interest is in selling their brand rather than commissioning quality architecture. Heathcote criticises that these meuble objects are not art pieces; they are design. Neil Cummings refers to the design of architect’s furniture as art as the “look at me!” syndrome.

Zaha Hadid has used CAD software Rhino to bring her paintings into 3D forms, creating slithering meuble, semi-meuble and immeuble, creeping across the landscape. These objects are surface focused, failing to express their process or structure. Hadid as a brand is an architectural cultural commodity; when objects such as Hadid’s meuble Aqua Table sell at auction for $296,000 in 2005, one starts to question what purpose these design objects are really designed for.

Steven Holl’s meuble furniture experiments with and captures the concepts of his immeuble. Figs. 3.15 and 3.16 illustrate the dappled light created by his laser cutting technique in both scales; however the white colour allows the light to have greater impact however. Holl’s work is also not mass produced, and is ‘price-on-application’ only. Aalto’s small runs of...
his furniture were able to be made beautifully with high quality control, but mass production processes helped to keep costs down. This enables the work to be less of an architect’s cultural commodity, but ensures quality.

Manupipatpong’s work also look to capture that which lies between furniture and architecture. His installation *Space Between* in fig. 3.17 plays with scale to question the categorisation of the objects. He states the objects are “too small to categories as architecture, but rather too big to see as a piece furniture.”

This installation becomes meuble furniture once inhabiting an interior space, as it deals with meuble furniture concepts, such as the “platform with different level for seating, laying, leaning.” When placed outside, it becomes immeuble as it contains space.

This installation does not strictly classify as semi-meuble, as it is not built into the immeuble. It aligns more with the concept of meuble, even though it would take some work to move it. This brings into question how different meuble and architecture are. Bernard Cache argues in his book *Earth Moves* that meuble can be seen as an “interior replication of architecture” 29, that tables, chairs and beds are simply a more convenient extension of the floor.

Manupipatpong’s installation *Shelter of Nostalgia* in fig. 3.18 interacts more with the immeuble. The same element between furniture and architecture is explored, treating it like a ‘tree house’ wrapped around a column. This classifies the structure as more semi-meuble, as it is physically attached, therefore blurring lines between immeuble and meuble. It is also a transportable structure, making it a relevant precedent for this research project.

---

CONCLUSION

By employing the semi-meuble and acknowledging the control of space that meuble can have, an architect is given more opportunities to create dynamic spaces. Thus, ignoring meuble arrangement in a large scale project gives opportunity to have a concept undermined.

By testing techniques, tools or material on a smaller scale, technological and material investigations are easier to carry out due to cost and time. By investigating on a real working object, like a meuble chair, it insures the product has strength and durability, as well as aesthetic appeal. This scale translation is a successful way of understanding a product and process, as exemplified by the many successful precedents.

It seems that an architect could be trained firstly as a crafts-person, such as Bruer, or form a very close relationship with a crafts-person, like Wright and Aalto. Both combinations have produced highly renowned work, which shows that one does not need to formally train as a builder before being an architect, but must at least form dialogue with someone with the skills.

The issue of authorship comes up repeatedly when looking at designer’s through their furniture, rather than their architecture. Notably, female designers are often ignored.

Architects are still specifying architect-designer ‘design classic’ meuble in our architecture today. Perhaps this is because they allow space to float through them, not interrupting our carefully carved voids. Or perhaps because of their esteemed nature – most people specifying an Eames chair, for instance, may not be conscious of what it is doing spatially, but know it has remained ‘in fashion’ and therefore is a solid investment. By utilising meuble to explore not only technology, and spatial organisation, we could utilise furniture to experiment with the way we market and brand our architecture and ourselves as architects.
PROJECT DEVELOPMENT

SITE SELECTION & EVALUATION, DESIGN PROCESS & ALTERNATIVES
A site selection process determined three typical Auckland City urban cavity sites. By initially testing the sites with two architectural concepts, a greater number of ideas with less constraints were tested. The successful parts of these schemes were then combined into one concept and developed into a further resolved building, with respect to planning, structure, services, form and use. Throughout the process, design concepts were again tested on chairs. This developed concept was then detailed and resolved further, taking a number of building details and constructing them at a 1:1 scale. At each of these six stages, a formal crit. presentation was given to gain external criticism. Extra design process steps that are not as relevant to the research question are included in the appendices.

All stages were informed by furniture making, site assessment, and theory and precedent analysis. This enabled relevant information needed for each step to be constantly updated, encouraging a reflective process, rather than practicing these activities in a lineal process as mere formalities. The design development section of this research project is structured according to this framework.
This project assumes that successful cities are like a well planned building. They consist of dwelling spaces and transition pathways, entrances and apertures. ‘Missing teeth’ sit in cities as if they were rooms in a building which need furniture to make them useful rooms again. The proposed building will then fit into the room as a furniture fit out might, with immeuble, semi-meuble and immeuble interventions.

At the beginning of the research process it was proposed to work in a sequential scale order, as seen above. Furniture (micro scale) would inform a building (mid scale), which would then inform how the building would fit in the space (macro). However very early in the design process it became apparent that one must work at all scales simultaneously to design, as shown below. The theory of semi-meuble also sits in between the micro and mid steps.

Trying to design furniture without any purpose or constraint isn’t design, it is simply making for the sake of making; and trying to assess a site with no program or initial constraints is just as impossible. A building material discovered in a neighbouring building may well help inform a chair, or a certain joint discovered in chair making may well inform how the building connects to site.
SITE SELECTION: MISSING TEETH

Fig. 4.4 shows thirty-six identified missing teeth in Auckland’s CBD, defined as areas within the motorway triangle and lying around its periphery. Although it is estimated there are several hundred around wider Auckland. This is different to most studies of missing teeth, taken in American cities such as Detroit. Hubert Murray explains Boston, Massachusetts’ missing teeth are caused by “weed-and-seed” programmes, which evict tenants with drug-related offenses and bulldoze the units. Urban design critics Duncan Crary and James Howard Kunstler argue the missing teeth of Troy, New York, are caused by taxation on buildings — landlords are reluctant to spend more on construction as it would give the same rent return, would result in more tax, the overly stringent building code laws prevent much development, and car parks currently have better tenancy than buildings.

The Auckland sites differ in their lack of “weed and seed” programs, although the reasons many of the sites seem to stay as missing teeth are similar to Kunstler and Crary’s propositions of economic and political cause. Notably most of the Auckland sites were affected by significant earthworks, to make way for motorways or ports (For example around the North-Western Motorway, constructed in 1969, or Wynyard Quarter, where reclamation started prior to 1841). However this could be because sites near motorways and wide roads are always somewhat terrain vague. These spaces also most often occur on busy or very wide roads, or at the backs of sites that front onto these busy roads (for example Ponsonby Road or Karangahape Road). The majority of the spaces seem to be clustered rather than scattered. However, this may be due to the surveying method of field research in which sites were identified by foot. Other reasons for these cavities include a lack of pedestrian or vehicle traffic, and economics. The sites are often unfinished construction projects halted during the recession. All missing teeth differ in terms of previous use. Some were residential, some industrial and some hadn’t been filled in approximately 60 years, as shown by historic aerial photos, featured in the individual site reviews.

The effects of missing teeth on the urban environment are: unsafe walking areas, discouraging pedestrians (dark spots); loss of rental incomes; increased supply of parking for cars in city which in turn discourages use of public transport; utilised as areas for unwanted illegal activities; no in built drainage systems and sealed surfaces causing excess water runoff; disrupted urban fabric, and affected aesthetics. Most of the spaces are now used as carparks, located on valuable land that has been indicated in the Auckland Council’s 2040 Draft Plan as ‘development hot spots’.
SITE SELECTION:
THE MISSING TEETH OF AUCKLAND CITY

[Images of various urban sites with labels 1 to 36]
Fig. 4.4 - Map of Urban Cavities in Auckland CBD, Not to Scale
These thirty-five spaces can be categorised as being one of three types of ‘room’. Three walled ‘room cavities’ are spaces that feel enclosed. There is an almost uniform set of roof heights surrounding them creating the illusion of a ceiling. They may have apertures from the surrounding buildings, but only have one main entrance. The two walled ‘hallway cavity’ has two walls on either side of the urban room, but the back of the site drops off, creating multiple entrances. This may be because the rear site hasn’t been developed, or the buildings to either side stop short of the site. The ‘broken room cavity’ has different scales of buildings adjacent—for instance a skyscraper on one side, and a two storey building on the other. It may have very large apertures, or different shaped entrances. It has been developed over time, and may have a complex set of apertures linking it to other ‘rooms’.

![Fig. 45](image)

Typical Room Cavity
Three Even Walls

Typical Hallway Cavity
Two even walls with no back

Typical Broken Room Cavity
Uneven Heights of Walls

The categories range from small (less than 150m²), to medium (150-300m²), to larger scale (300m² plus). This project will include on fitting into all types of room category, but will concentrate mainly on those of a medium (150-300m²) size.

![Fig. 46](image)

Triangular

Wrap Around Cavities

Long, Thin Alley-ways

Atypical site shapes consist of triangle sites, often on the corners of city blocks, or wrap around cavities connected to an alleyway. These atypical shapes and scales are excluded from this project, as the large number of more typical cavities in the city give enough opportunities to justify this project’s need. The proposed building will be designed to fit in any one of the typical cavities, but three sites in particular have been chosen for the purpose of design. These sites range from completely flat (Halsey Street), to the top of a medium slope (Galatos Street) to the bottom of a steep relief (Dacre Street). They are also situated at a range of geographical points in the city. The design of the structure to fit successfully into this range of sites will indicate an ability to fit into all typical sites successfully.
All three exemplar sites are within the same Auckland CBD environment. The average conditions are:

Average annual rainfall: 1240mm

Average annual sunshine hours: 2060

Average summer temperature: 20°C

Average winter temperature: 11°C

The high rate of rainfall means that all sites must be sheltered to be used as workshops. Moving the structure during winter may also be a problem, if it is to rain on the days and certain objects may not be capable of getting wet. The need for machinery on the site, which could be an electrical hazard, means that rain entry must be controlled.

Temperatures that average between 11-20 degrees means there can also be some allowance for passive ventilation and less of a need for a central heating system.

Sun studies were completed as necessary but site specific studies such as traffic counts or mapping exercises would not impose much influence on a mobile building, as it is community based depending on location.

SITE DESCRIPTION:

GALATOS STREET

Fig. 4.8 - Galatos Street Site Images and site axonometric as an immeuble ‘room’

Fig. 4.9 Aerial View of Galatos Street, 2011, 1:1000 @ A4

Galatos Street lies behind Auckland’s iconic red light district, Karangahape Road. The street has recently had a small gentrification. The small industrial and historic brick buildings now house offices of creative industries, hospitality and small business, accommodation and a church. It is important to take extra care with existing apertures of the neighbouring buildings, to not cut off their air and light supply.

Existing meuble furniture consists of cars and ‘skip’ bins. The site is a medium sized typical room cavity, and contains only a few apertures. A small fire escape is situated to the east of the cavity. Roof heights are quite even, and the wall to floor ratio quite high, creating the visual aspect of a internal room with a ‘ceiling’. This ideal room layout means fitting out the Galatos Street site is the central focus, with the other sites secondary.
SITE DESCRIPTION:
HALSEY STREET

Wynyard Quarter’s evolution started with the reclamation of Freemans Bay, gradually extending to form Halsey Street. Further wharf extensions were added over time, and the use of the site changed gradually. Used for light to heavy industry, it’s location on the Auckland Ports made it easily accessible for trade and shipping. Waterfront Auckland has been appointed to oversee a redevelopment of the site. The cavity proposed to house the building is surrounded by creative industries, restaurants and light industrial and accommodation.

The meuble furniture on the site is several ‘skip bins’, a boat and cars. It is a typical room cavity, with one entrance to the east and a small door from the building to the north. There are no apertures from surrounding buildings. The wall to floor ratio is quite low, making it feel less enclosed than Galatos.
SITE DESCRIPTION:
DACRE STREET

Located in Newton, South of the CBD, Dacre Street was once well connected to the city’s grid plan until the 1969 north-western motorway development. The Kings Arms, a historic Auckland pub, is located to the north of the gully, one of the last remnants of the history-rich area. Dacre Street is currently home to a number of design and marketing agencies and cafes to the south of the street. The north side (facing the motorway at the back) is predominantly industrial use, as the sites are much bigger, enabling larger factory structures.

The site contains a number of furniture-like objects already — such as large ‘skip’ bins, cars and shopping trolleys. It is a Typical Broken Wall Cavity as it has another car entrance to the east, and rises 3 metres in the centre of the site. It does however have a enclosing wall to floor ratio, making it feel very internal.
CONCEPT ONE:
BLANKET CHAIR BUILDING

After site analysis revealed reasonable urban cavities, the scale of the project’s focus was shifted to a meuble scale. The construction of the ‘Blanket Chair’, although lacking in craft, resulted in a chair with a simple concept that could be translated into architecture.

Making the ‘Blanket Chair’ gave architectural insight into:

• Joining chipboard members to the existing chair frame gave ideas for joining the building to the existing urban cavities’ forms. This was achieved by using the weight and span of the blanket over the chairs, without physically attaching to the frame.

• Ways of creating a meuble ‘lightness’ were achieved through the draping motion that separates structure from seat, making it seem lighter, as well as utilising lighter colours.

• Adaptive reuse of material acknowledges the economic and environmental aims of the project, as they cost less than buying the material new.
The translation of this first investigation was then attempted to inform a meuble architecture. In fig. 4.14 the chair’s structural system, form, material, and spatial interaction were translated in a series of sketches. The architecture looked at being a meuble object; the concept of semi-meuble was not developed enough at this stage to inform architecture. The final architectural concept consists of frames stacked and draped with strips of ‘blanket’. The scheme treats the blankets as a services system, containing solar panels, rain water harvesting, green roof and sewage treatment.

Research into mobile buildings showed several common themes; modular structures made of solid parts that could be reassembled, structures made of stick and joint systems, and whole structures that inflated or deflated (refer to Appendix One). This scheme proposes a modular
system. The proposed structure is meuble in its lightness and interior, in which space is a large void, but is semi-meuble in its scale and inclusion of services in a mobile element, the blanket roof.

Once the architecture concept was developed, the design was bought back to a meuble scale, where detailing issues were more visible and solutions could be found through making, rather than guessing. Investigations informed architectural conclusions:

- The chipboard’s vulnerability is ameliorated by a gradient effect paint veneer, starting at the bottom of the blanket where most of the ‘wear and tear’ took place, graduating to a raw finish at the top where very little handling or touching of surface occurs. This effect will be utilised in the finishing of the building.

- The leather back stops the blanket from sliding and adds flexibility. Attaching the structure to the walls of the cavity can also utilise resistance and draping, and a flexible system means it will be able to drape over different roof shapes easily.

Fig. 4.15 Blanket Chair Number Three. Discarded staff room chair frame, kitchen cabinet chipboard, hole-ridden leather pants, staples, acrylic paint
It was found that stapling too close to the edge of the leather made a weak joint, and certain amount of paint could be applied to a chipboard sheet without causing swelling, informing future detailing of the architecture, for example water proofing.

A bar was added across the top of the frame to prevent the leather from breaking - the maximum amount of surface area contact is important for strength, meaning the blankets of the building must reach extensively over the neighbouring roofs.

1:500 scale models of each site tested massing studies of the sketches at architectural scale, along with findings of the second chair — the backing fabric, use of veneer, and surface area of blanket over roofs. Strips draped across the top of modular units aid in creating an internal environment, provide the services needed to operate the building and perhaps even structurally ‘dangle’ the units above ground. These strips provide a ‘roof’ plane giving weather tightness. The frames are easily transported and stacked.
By collaging photographs of the second Blanket Chair onto scaled drawing of the sites, the 1:500 models translated into the spatial diagram in fig. 4.17. The diagrammatic section of Dacre Street demonstrates:

- A representation of scale, space, form, light, layout, navigation and utilisation of meuble and semi-meuble. The proposed construction method is shown by the technician draping ‘blanket’ structures over the top of modular frames.

- The building can be transported by stacking up these frames like a chair, shown on the road. The blankets can be stored inside the frames for easy transportation, much like the Blanket Chair can roll up and sit in its frame.

- A semi-meuble nature is proposed to be created by the extending blanket ‘arms’ blurring the edges of the site, the frames aim to be meuble in their lightness and lack of fixing to the site.

- The ‘event’ (See appendix one) caused by the building’s construction — rolling out the blankets is an unconventional building process that will attract attention to the project and promote participation and occupation.

Making chairs to inform architecture provided the opportunity to learn several skills, gain knowledge and improve values. Knowledge wise, physically making objects meant that decisions have to be made quickly but intelligently. All outcomes were not able to be predicted, for instance the elasticity of the vacuum cord on the first blanket chair. A whole new chair had to be constructed to overcome the challenges because the hole had already been drilled. It provided knowledge about material — the limitations of chip board, and elasticity in joints. Construction skills learnt were tools such as drills and hammers. Essentially, making informed the interaction of existing objects with others - which informed the interaction with urban cavities. Values included those surrounding the ecological principles of adaptive reuse of material.

The positive outcomes from the architectural concept are the draping form, which made a semi-meuble way of covering site and frames. Including services in modular units makes it faster to move and install the building, with little site works needed. The blanket structure is also very flexible, making the idea suitable for many types of cavities. Unresolved issues of the architectural concept are the connection of the blankets to surrounding buildings, and that the weight of blankets may be too much with services on them. The weight of certain objects in stacked units could be an issue and hanging units off the blanket may be structurally difficult.
CONCEPT TWO: 
TEA CHAIR BUILDING

The Tea Drinking Chair as a design process tool concentrated more on the construction process, utilising more complex tools and techniques. Findings were translated into the building at a form and conceptual level, like the blanket chairs, but also by utilising tools the actual structure would be built with.

Making the Tea Drinking Chair gave architectural insight into:

• Fitting in the top of the seating frame is a herb garden that can be picked to put in your cup of tea. By utilising a building service of a ‘green box’ in the meuble, to see if it then makes the chair into a semi-meuble object. The service’s forms do make the chair look more solid, but maybe just as a category D meuble object.

• Chipboard was used again as it was readily economic, giving opportunity to upcycle it. The chipboard in essence is modular timber at a micro scale. The ability to patch it up, with wood chips and glue, makes it forgiving and flexible. This idea will be used in an
architectural scale, by replacing damaged modules rather than having to fix parts of a building. It is also an economical material, but not environmentally sound, but since this is recycled chipboard this can be off set.

- The surface finish was investigated by sanding back the frame of the chair to steel, but when juxtaposed with the chipboard it had too much texture and grit. It was thought that the steel’s shine would help to emphasise a meuble lightness, but over-night rusting meant that not painting the frame would require environmentally toxic products to seal, bought new, unlike the chipboard. Thus all metals in the structure will be sealed with non-toxic paint, in the building and the chair.

- The shape of the rockers were determined by full scale testing. The angle of the legs were slightly uneven, causing the whole chair to tip when rocked. This points to structural issues in architecture - moving proponents of buildings should be physically tested to ensure they work. It proved that the lower down a ‘rocking’ object is to the ground, the safer and more stable it is. It was originally thought that this rocking motion would be translated into architecture.

- The angle of the shelf was needed when one sat on the chair and the bottom part of the shelf was too far forward, so was sanded back to its current shape. It is useful when designing a building to see measurements or forms at scale to judge how people might interact.

- Problems were caused by assumptions about tools and techniques. There wasn’t a saw in the workshop wide enough to cut down the length of the chair (approximately 150mm). When constructing buildings, it is therefore important to understand the limitations of the tools you are utilising to construct your design.

Ways of re-scaling the chair were examined through hand sketches and Photoshop collages, shown in fig. 4.19. The final solution worked in the same way as the side detail of the chair, as a cube splitting open to make two forms that can be used as a building and to transport the machinery.

It was pointed out that the programme may be suited to using shipping containers. Using a shipping container means that circulation space has to be transported, moving containers that are not full. By collapsing cubes, space can be maximised and machinery transported safer (as they will be packed tighter, with less room to move around inside the box).
The two first images utilise the rocking motion to fill the cavity. The rocking movement cannot be used to make buildings mobile however. The side detail of the chair was explored at mid scale for its capability to separate and move around existing forms, like the chair frame.

Fig. The form separates in the centre, like the chair detail. These two parts then form the immeuble surroundings to a space.

Fig. 4.19 - architectural development of the Tea Drinker’s Chair
The final concept consists of a canopy between the span, which will be tent like. The box shapes stack on top of each other, as shown in fig. 4.20. The detailing of the corners presented a number of issues such as how to connect the smaller members on top and bottom. A ‘log cabin’ like stitching of the corners connects, but a more successful connection could have related to the chair’s detailing. The open and closing of the boxes on-site provides the sense of ‘event’ that mobile buildings often need to create a context (See Appendix One).

Positive outcomes from this concept included a theory regarding transporting as little circulation space as possible. The suggested stair layout aids in easier circulation. Unresolved issues include a system that joins fabric to the box structure, and a solution as to how get services into the building. A solution as to how to deal with machines attached in the upside down part of the box needs to be found. Architectural learnings from making chairs were gaining knowledge in timber jointing systems, and skills, knowledge and values of upcycling chipboard in the building including how to fix gaps by puttying with sawdust and PVA. It was also learnt that ‘rocking’ structures closer to the ground will be stronger. Practical skills included use of tools, like grinders, band saw, jigsaw, belt sander, table saw and drop drill. The use of these tools aids in research about workshop spaces for the programme of my building.
COMBINED CONCEPT: MEUBLE MAKING STUDIO

The combination of the modular and malleable from the Blanket Chair, and the idea of the ‘pull-apart’ cube from the Tea Drinking Chair were integrated into one concept. The previous cube formation wasted spaces in the top corners — thus the cube was developed to cut at each corner, expanding to become four tetrahedron units, as shown in fig. 4.21. This form transported the least amount of empty circulation space. Each workshop machine and building service could be placed in a tetrahedron, fitting compactly as a square shipping container for transportation.

Fig. 4.21 - 1. The tetrahedron as a partial cube. 2. The tetrahedrons jointed together. Colour coding the outside allows the technicians to assemble the building quickly. 3. The spare boxes could possibly be stacked on site, like the first scheme, if they did not contain fixed elements on the inside. 4. A spinning top formation could form an interesting work space. It also looks meuble.
Fig. 4.22 is a Photoshop collage created with photographs of the chipboard models and the Galatos Street site. It illustrates the tetrahedrons in a ‘spinning top’ formation. The formation was combined with the flexible blanket as a roof structure, like the blanket concept. However, circulation from unit to unit would not be possible as the four walls of the tetrahedrons block the path. Structural stability is also an issue, much like when the Tea Drinking Chair was not as stable when the mass was higher. The left over space around the units does not interact with occupying urban cavity, by ignoring the semi-meuble and only filling it with meuble.
Fig. 4.23 - Photoshop collage of the Dacre Street Site
Fig. 4.23 shows the front elevation of the building spreading across the cavity, forming a smoother urban frontage for those walking past the building. The tetrahedrons needed to span the front in this arrangement for the width of the cavity. This would have to be specifically designed however for each site, compromising the modular aims of the construction process. The progression from unit to unit allows for quite a safe environment, in which one machine is sheltered from the next, and sheltered from passers by, as seen in the plan.

The tetrahedrons were then moved to the outside of the cavity, to create semi meuble. A more uniform approach to planning was taken, shown in fig. 4.24. This plan allows existing meuble, the cars, to park more successfully around the structure, under a suspended first floor. A long thin circulation passage lays over the centre of the car parking network, while the width of the tetrahedrons (at five metres wide), cover the space over two cars, allowing for smooth parking. Five metres is too wide for a conventional truck to transport easily however, this was later changed to a width of 2.4 metres that is more appropriate for transport and fitting a conventional car beneath.
The construction of the building at each site needed to be designed just as much as the structure in transport and in occupation of the cavity. Hiring a crane every three months when moving the building would be cost prohibitive for a non-profit project, and could be a lost opportunity for a sense of community. If the local community are able to ‘make’ the building themselves, ownership and social capital (see appendix two) will be encouraged, thus contributing towards the aim of social sustainability (see appendix two) for the project. The process of assembling the semi-meuble is choreographed:

1. Three people take each corner of a tetrahedron, pivoting it into place.

2. Approximately 5m high steel V profile columns are attached to the spine of the tetrahedron

3 and 4. Another tetrahedron is pivoted in and pulled up against the column and locked into place. It was originally conceived that a car would then pin down the structure, but this would require a suspended floor, with the cars underneath. Therefore pinning down the structure must come from within the structure itself.

5. The side rows of tetrahedron is then locked in, working as a space frame to support the structure.

Much like the architecture precedents featured in appendix one, this construction process will create an ‘event’ that attracts attention to the structure, encouraging occupation, and promotes discourse on construction.
The photographs in fig. 4.26 show the model made to test the first roof concept, developing the blanket roof structure. The tensile wire roof is pinned at the base, pulled up the V profiled column spine of the tetrahedron, and stretches across to other tetrahedrons in a splaying motion.

Fig. 4.27 also details a possible roofing use. By utilising tensile wires, fixed at the tetrahedrons base, the roof also work as a storage system for spare timber. It also details an idea for how the building might take all sawdust and turn it into MDF (Medium Density Fibreboard). However it was commented on that the energy required to compress MDF would be too much for photovoltaic units. The cars below were suggested to provide the weighted anchor to counter the tensile action. However, this is not structurally sound.

The positive outcomes of the combined concept were the tetrahedron shape, which transports less circulation space and is more efficient. The combination of a flexible tensile roof from first scheme with modular boxes from second scheme ensures fitting in all cavities. Unresolved issues are that the services system solutions are not obvious. The assembly of complicated tension roof may take a long time, and the windows from the neighbouring buildings are blocked off by semi-meuble installation.

Architectural learnings from making at this stage were the knowledge and values regarding the use of chipboard that were carried over into this scheme, utilising the ‘modular material’ for the tetrahedrons. Knowledge about how the tetrahedrons are to be constructed and with what tools was useful — the spine angle allowed for the structure to be held, which would not have been realised without the small scale models. Knowledge and skills gained from using tools also informed spatial arrangement of the machines in the work space.
Fig. 4.27 - Diagram of structural components and how the building works to create MDF
DEVELOPED DESIGN:
SEMI-MEUBLE LAYOUT

The issues highlighted in the combined concept were then tested and developed, dividing the design process into parts to resolve individually. Firstly the semi-meuble layout is investigated, followed by the programmatic requirements, the roof structure and finally its assembly. The process of dividing the project into parts allows resolution on a more detailed scale, again utilising chair making to test ideas.

The issues with the layout of the previous design of the semi-meuble were ameliorated through a series of CAD (Computer Aided Drawing) modelling studies.

1. and 2. Pointing the tetrahedrons toward the front of the cavity, stopping them from relating to each other formally. These were then rotated back to face each other, so that a tension floor system could be better achieved.

3. Rotating the front boxes slightly to create a smoother facade was tried, but looked disjointed and created connection problems. This model also experimented with a short spanning butterfly floor system, for sweeping sawdust into the centre. This helps to push apart the tetrahedrons structurally, but it’s weight may be hard to balance.

4. A second layer of tetrahedrons behind helped to lock them into place structurally and create an interesting ‘zig-zag’ interior. A tetrahedron to the outside of the formation could be skipped if a neighbouring window needed light access.

5. Further experimentation with the tensile floor looked at diamond shaped structure. This is still a large unsupported span however.

6. Utilising a car to pin down the structure adds weight to the bottom of the tetrahedron stack, but would be unstable if car is moved.

7 & 8. Utilising smaller tetrahedrons to create a structural grid was explored, but did not provide an answer of how to span across such a long distance.

It was decided that having a second floor is more suitable. This means the exemption of cars, but creates a larger open space, a higher stud height, leads to less structural issues, and allows for each of the tetrahedrons in the space to be seen at once, enforcing their position as semi-meuble rather than simply as walls.
Fig. 4.28 - Development of the layout of the tetrahedrons
A model was created to test this layout, shown in fig. 4.29. The double height space extends the length of the site, leaving the front facade open. The tetrahedrons that face the back of the cavity are left as stick frame systems, allowing a light shaft behind the unit, for the surrounding neighbours. The tetrahedrons are to be constructed from both translucent fabric and chipboard sheer panels, so that light can transmit from the back of the semi-meuble and enable further day lighting for the machines on the lower floor. The contouring of the site leads to a gap beneath the front tetrahedrons- this can be used for storage, and plays on whether the units are meuble or built in architecture. Towards the back of the site they seem heavy and anchored and towards the front they are lighter and suspended.
DEVELOPED DESIGN: PROGRAMME

The tetrahedrons each contain a different service or programme. These include the workshop needs, but also those of the technicians temporary living. Uses are:

Machines (informed by own needs whilst making furniture in the workshop):
- Table saw x 1 (unpacked and located in the centre of the space)
- Multi drill x 1 (needs to be on bottom floor)
- Band saw x 1 (needs to be on bottom floor)
- Belt Sander and rotated sander x 2 (needs to be on bottom floor)
- Welding x 1 (needs to be on bottom floor)
- Sewing x 1
- Smaller hand tools are battery charged, so able to be used in the main space cordlessly. Other possibilities considered: 3d Printers, 3d Router, Laser Cutter. These were dismissed because their high power usage is not able to be supplied reasonably by solar energy.

Other uses:
- Display space for chairs made in facility/ objects for exhibition
- Toilet facilities x 2 (must be located next to a water tank)
- Vegetable gardens x 4
- Water storage x 5 (needs to be on bottom floor)
- Solar batteries x 5 (needs to be on bottom floor)
- Office facilities x 2
- Saw dust storage x 2
- Black water storage x 1

Needed for temporary living spaces:
- Living
- Bed x 2
- Kitchen
- Dining
- Showering
These uses are arranged according to their programmatic needs, as shown in fig. 4.30. These include:

- Solar batteries and water storage need to be located in the bottom storey of the semi-mueble structure due to their weight (see services section).

- The living spaces can be located on the first floor for added privacy (see appendix eight).

- Exhaust extracts need to be further considered; a lot of saw dust was produced during my own work in the workshop.

- Many tetrahedrons will have a cupboard door attached, that allows one to lock up the space at night- a front facade was taken away to make users feel as if they could walk right into the space and participate. A lack of a front facade also means that the space could be used for other events at night like parking, movie screenings (shown in fig. 4.30), and gestures to the fact that it is still an urban cavity that will need filling. The ability to lock up the tetrahedron will be helped by the workshop technicians living in temporary housing on site overnight.

For the placement of machines, the building’s use can be classified as Medium Industry Craft and Power-Assisted Industrial manufacturing \(^{32}\) by The Metric Handbook. This means that it is used by small groups or individuals, creating small scale objects from both raw and

processed material. These types of manufacturing structures are often small-scale workshops or individual’s dwellings re-purposed, up to larger scales where buildings are traditionally long and thin on multiple floors, as shown in fig.’s 4.30 and 4.31.

The production method of “Team Technology”\textsuperscript{33} based work approach is best served by machines arranged in groups, as shown in fig. 4.30. \textit{The Metric Handbook} argues that this layout restores a feeling of responsibility and achievement in making situations, but has a large need for storage, that is interchangeable and flexible. This storage will be in tetrahedrons, but also under the structure, shown in fig. 4.31.

Fig. 4.31 also shows the light shaft behind the structure. All tetrahedrons facing cavity walls are structural stick systems, with no shear walls in their triangular frame, instead utilising transparent ETFE membrane (Ethylene Tetrafluoroethylene). This space frame gives structural strength. It also directs light down into the existing windows and into the back of the semi-meuble structure. The transparent fabric provides weather tightness but also gestures to the material behind, referencing to previous melancholy of the cavity.

DEVELOPED DESIGN: PROGRAMME - DRAWER UNIT

It was argued in a crit that machinery that needs access from the sides is prevented by the semi-meuble’s tetrahedron arrangement. Thus, the drawer type prism is proposed for equipment that needs to be assessed from the sides or back, like belt sanders or jigsaws.

Fold out tables can be attached to the sides for longer run timber; the drawer could also be locked up, with technicians having the only access to ensure safety.
After a first floor was found impracticable to the overall structure, the roof became the only immeuble structure. The floor and walls already exist from the urban cavity, but the ‘ceiling’ did not provide watertightness. Several options were first explored, shown in appendix seven. This resulted in a space frame roof, much like the wall structure, that blurred the lines between semi-meuble and immeuble.

Several space frame profiles were investigated:

1. A ‘six directional lattice system’[^34] at the edges of the tetrahedron was not rigid enough. There was a lot of movement along the middle join when the profile does not vary.

2. The strongest figuration resembled the same frame as the wall structure, a ‘double layer system’[^35]. However, the sheer wall infill panels would make the frame too heavy and would cause rain to pool.

[^34]: J. François Gabriel, Beyond the cube : the architecture of space frames and polyhedra (New York: John Wiley, 1997), 444.
3. By utilising only the framing system without the shear walls means one weather sealing ETFE membrane can be put over the top of the structure, making drainage simpler. The ETFE, laminated with photovoltaic laminate, also creates the diffused light needed.

4. This image illustrates the connection between the roof space frame and the wall space form, as seen from the interior.

A further addition to the assembly process, which helps to create community involvement, was the construction of the roof. This is completed in a similar choreographic process as construction of the wall system, designed with help from engineer Mark Mismash. The process tried several ways of pivoting the space frame, as shown in fig. 4.34. The resolved process is illustrated in fig. 4.35.

1. The space frame is assembled at ground level, after the walls have been erected, mimicking the wall’s structure. These are hinged at the top, and a pulley tension wire is attached at this hinge.

2. The entire roof, pulled from behind the structure, is then lifted by a team of people at each column, pulling backwards.

3 and 4. Once the two halves of the roof have been pulled back, they snap together in the centre. This creates an essence of ‘barn raising’, which can be completed by the local community. Cranes could be used in poor weather or if not enough people are able to be rallied; the social capital gained however from a group of people doing such a task could be immense.

In addition to this assembly, a pre-camber ensures the ETFE does not pool. A ridge in the connection joint between the roof bays provides a point for the membrane to peak.
Fig. 4.35 - Assembly of roof structure
This section outlines the smaller scale detailing of the concepts of the developed stage, informed by chair making. Included is the meuble elements to be included in the building, tetrahedrons used for housing machinery, vertical circulation, horizontal circulation, services research, joint investigation and material investigation.

The tetrahedrons pressed up against the wall were not recognised as semi-meuble in crits. Category B-D Meuble objects in the centre of the space that allowed space to flow through them were developed to contrast with the semi-meuble fit-out.

Making the ‘Wool Chair’ tested what made objects meuble. It gave meuble insight into:

- A lighter colour allowed the chair immediately to seem lighter in weight.
- The object must be transparent and have a very thin structural system.
- When covered with a sheepskin rug to provide comfort, as it was viewed as an ‘add on’, the sheepskin still allowed space to pass through.

The chair was useful as a design process tool for determining the elements a meuble object would need, but not able to be used for the actual building program. Thus a meuble object, that allowed space to pass through, for the actual design was developed.

Fig. 4-36 - the Wool Chair
DETAILED DESIGN: MEUBLE TABLES

The design for a meuble workshop table was first investigated in fig. 4.37, by using the principles of the Wool Chair. The tetrahedron formation was used to provide form.

1. The inclusion of sheer walls means space cannot flow through — if there is to be solid objects, it must be an ‘add-on’, like the sheepskin.

2. By taking some of the sheer walls away, the object appears more meuble. The thin structure and light colour mimic those of the Wool Chair.

3. By taking all sheer walls away, the object looks very meuble. Structurally it cannot stand up on its own however, and it is unclear how people are to use it, especially for long span timbers.

4. By making the object rectangular cube shaped, it is able to sit flat on the site. By utilising the diagonal motion of the tetrahedron to form a ‘back’ to the table, the cross bar frames space, much like Wright’s dining table arrangements — higher backs of chairs help to define smaller spaces. Arrangement in the space will be so ‘back’ of the tables are facing towards the semi-meuble, encouraging those within it to feel as if they are in an insular space making together, creating social capital. It also means that those working within the circle are standing on the other side of the table to the machinery, creating a safer environment.

5. The stool tested the cantilever effect to provide the illusion of lightness. The thin cube shaped structure was cut off on one leg, stretching to meet the other corner diagonally. This helped to make the object’s top, the heaviest part, seem lighter. The top of the stool was constructed with scrap pieces of timber and chipboard, testing to see whether the edge condition of material would affect heaviness. It doesn’t have an effect, as long as the material is structurally stable, the same widths provide the same light feeling.
Vertical circulation is needed to get to the upper level of the semi-meuble wall structure.

1 and 2. Vertical circulation was started as a tetrahedron containing a stair case system, meaning circulation must be located in specific points - one could not move it around to get from prism to prism. This was when there was a second floor to the structure.

3. Circulation was then developed as a series of smaller tetrahedrons in a ladder formation, but one could not carry objects easily, and the ladder may slip on uneven surfaces.

4. and 5. Finally a cube shaped unit was designed, which allows one to transport the circulation around the unit — like a library ladder. It utilises the meuble principals of being very light and easy to move around, but can be tucked into a structure at night, providing more intimacy like Wright’s table arrangements (see section ‘Architectural Utilisation of the Meuble’).
DETAILED DESIGN:
HORIZONTAL CIRCULATION

Horizontal circulation, instead of a floor system, became a part of the tetrahedrons, developing into a balcony that extends over the space.

1 and 2. This was firstly developed as a bridge that ran the length of the space (1), then a mezzanine at the rear of the space (2). These would both require large structural members to span the distances, which are difficult to transport and would have to be resized at every site.

3. Instead, circulation comes from the boxes themselves. A hinged door was developed that folds down to become a walking space, with a secondary hinge that acts as a barrier. The same door system is located on the ground floor, for ramping up to spaces that are not level with the ground and for locking up machines at night.
Max Hynds, services engineer, suggested connecting services to the city grid at each location as the rates paid for each site already cover the services supplied. It would be appropriate as these sites will have to connect to power, water and sewage when developed after the building has moved. Perhaps the connection to services could enable another temporary structure to inhabit the site after the making studio has left; or make future development of the sites an easier process, bettering the urban environment. It was decided however to have integrated off the grid services within the building, meaning it could be quickly adapted to any site, without extensive engineering. Connection cost would be prohibitive for only an average three month occupation of the site - services engineering and site works would add greatly to cost and time of set up.

Several services systems were examined for their suitability for the project. The project had two special circumstances to acknowledge when designing services systems — that the building will be off the grid, and also that the building is mobile. This means conventional systems for either of those situations had to be integrated with others and adapted, utilising waste and ensuring lightness in weight. This formed a whole cyclical system, where services complemented each other.

Integrated services project The Phillips Microbial Home\(^\text{36}\) looks at home services as a cyclical

system—each waste product made from a service, such as vegetable scraps or human waste, is converted into energy for the next service. Little or no connection to a grid is needed. This provides a model for the way services work in the housing area for the technicians.

The Philips Bio-digester kitchen island was modified for this design. It works in a cyclical system by utilising household waste. Vegetable scraps are collected and fed into a ‘methane digester’, which breaks down waste with bio-bacteria, burns it and converts it to methane which is then fed back into the stove and to the food storage prism’s fridge, supplying gas. Hynds also suggests back up LPG (Liquefied Petroleum Gas) tanks to supply this if the methane should run in short supply, if the users do not create enough. The kitchen and shower tetrahedrons also uses solar hot water, from a unit installed into a tetrahedron on the roof. Cold water is filtered rain water from the roof. All pipe and service connections from unit to unit are reconnected at every location using a ‘snap lock’ air pressure system joint—Hynds explains it is the same joint used when on the nozzle of a car tire pump.

Black water from the bathroom is also fed into the compost system, creating more methane. Grey water is separated from the toilet, an Aquatron cylindrical composter37. Grey water is also separated from the sink and shower, filtered and either re-used to flush the toilet or if there is excess, the filtered water is flushed into the storm water pond below the structure. This storm water pond is open to the workshop and can be released in heavy rain, allowing water into the storm water system when too much is on site.

Photovoltaics, laminated to the EFTS fabric roof, provide electricity for power tools and lighting. OPV (third generation Photo-voltayic cells) are thin and flexible photovoltaic panels that can be laminated onto fabrics, such as the products manufactured by Solarnext, shown in

---

Fig. 4.43 Meuble Making Museum Service Schematic, developed with the help of Max Hynds and influenced by the Philips Miocribial Home System.
fig. 4.42. A transparent active layer is sandwiched under a two protective layer of laminate and the EFTS membrane, much in the way it is traditionally laminated to glass. They have a self-cleaning surface, are flame resistant and can be manufactured in a variety of colours.

David Keppel, Managing Director of ‘What Power Crisis’ alternative power solutions has recommended for the project the equivalent of 6 x 190W solar panels to supply power to several tools and usual lights and services. These solar panels would provide a peak of 30 AMps at 240VAC. An average roof square meterage of approximately 400m² means that more than enough electricity could be provided by the fabric. The battery packs needed to house the power can be easily contained within a modular unit, although weight means they are better placed on ground level. The lighting needs are also able to be supplied by these panels; the Metric Handbook recommends 200–750 lux for a manufacturing situation.\footnote{38}

Broken down compost that has not converted to methane is at a stage where it is clear enough to be put on the vegetable gardens, which provide food for the larder. James Walkinshaw, landscape designer at Xanthe White Design, recommends a soil depth of 300mm to successfully grow these vegetables. Walkinshaw saw no problems with moving the units around, as long as they receive suitable sunlight. These vegetable gardens can also contribute to bee’s pollination of the beehive, which also feeds into the larder.

This cyclical system is several steps above the Philips experiment, incorporating more service systems and ensuring back up options should weather or site not be suitable enough. All systems are light enough to be transported.

Fig. 4.44 - samples of material investigation
The Tea Drinker’s Chair’s heaviness, almost too much for one person, meant that chipboard would be too heavy for technicians to lift and move around. Combining polystyrene with different timber composites looked to make the panels lighter.

Sample 1 exposes the polystyrene through a glass or Perspex sheet, giving explanation to structure whilst protecting it from weathering. Joining of the two materials is troublesome, with both having an aversion to most adhesives. Condensation between any gaps may also cause mold or leaking.

Sample 2 is made completely from three plywood sheets, making a useful comparison for how heavy a solid mass of material may be. It is the strongest of all samples.

Sample 3 consists of polystyrene with an air gap, surrounded by Perspex or glass. This allows for a gap for planting, alleviating the condensation issue. The air gap also makes the sample lighter, whilst allowing for insulation possibilities. Connecting of the two material is still an issue however, being very hard to make a clean looking joint.

Sample 4 consists of polystyrene sandwiched between plywood sheets. The short run section makes the product fairly weak, as a small bending moment could cause it to snap. Sample 5 ameliorates this, with the layers running long so bending moments have less of an impact. The strength of this system is quite high. Sanding down the edges of the panel caused the polystyrene to melt slightly, indicating a weakness but also creating an interesting negative detail. The use of this sample’s materials in combination with another system may have interesting results.

Sample 6 works with the method of ‘gunite’ concrete, but instead of cement, sawdust was used. This forms a hard timber composite surface, that is easily repaired and flexible. It is somewhat unpleasant to the touch however, it snags on one’s skin and feels rough.

Sample 7 combines polystyrene, plywood and a timber veneer to test the strength of each layer against each other. The plywood seems to be the firmest, with the veneer being quite fragile.

Sample 8 exposed the polystyrene, but as with sample four, the short run of the material meant a lack of strength. Sample 9 is a timber veneer on polystyrene. This is the lightest example but is harder to repair as it is less modular than the others. Finally it was decided to use a combination of material five in sample 9 (polystyrene in between ply), material six for rough areas that need to be patched up often, and a waterproof translucent fabric for panels that need to transmit light.
DETAILED DESIGN: TETRAHEDRON JOINT

The jointing system that connects the tetrahedrons was experimented with.

1. The connection joint between the prisms was explored as a ‘hinge and click’ system, which was not flexible in a horizontal direction, and may cause the metal to break.

2. A dowelling system may be successful when combined with another jointing system, but the stress needed for the dowel to pop out was a concern as well as easy the taking apart of the joint.

3. and 4. A zig-zag metal brace system again had concerns about malleability as did swing lock system and finally a tied system provided the malleability and easy assembly and disassembly the joint called for.

5. A 1:1 scale model illustrated that the joint needed weight and tying around a whole prism to become secure. It is easily disassembled, either simply unwound, or cutting the low cost wire or wool tie means one can quickly take down the building. Screws mean that the joint is easily fixed if it starts to become loose — simply screw in further to achieve more rigidity. This detail is not very practical however; so instead a simpler scaffolding joint is utilised. A ‘rapid scaffold node’ was utilised as a concept as it could be adapted so gravity was not as crucial in support, when the roofing system is lifted.
CONCLUSION

SUMMARY & CRITICAL APPRAISAL
The Research Question, Aims and Objectives

The aim and purpose of the design was to explore the relationship between furniture-making and building designing. The objectives were to analyse Auckland CBD’s urban cavities, explore construction methods, and look at occupancy of the site. The research project question asks: *How does the process of making furniture and applying it to architecture improve an architect’s design process, skills, values and knowledge?*

Urban Cavities

By selecting three typical ‘room shaped’ cavities the scheme was able to be tested for typical Auckland urban cavities. Utilising a transportable structure that is easy to build and subsequently dismount, the building is able to ameliorate the cavities predicament short term. Security is created by the interior feeling towards the back of the space and overnight occupation. By showing the local community what is possible with the urban cavity with little economic investment, perhaps a local political movement will be empowered to take ownership and ‘make’ the spaces more useful than their current state as car parks. Further analysis into how urban ‘rooms’ function in terms of path, axis, entrances and apertures may be relevant if researching urban cavities again. This project did not need to address this however; allowances for entrances or apertures have to be changed on every site regardless (the light shaft space on the sides of the building allow for the existing windows and doors), so other site restraints were deemed irrelevant. Perhaps further analysis would have uncovered common themes that would allow for a more structured approach.

Making to inform architecture informed the way the urban cavities were fit out with immeuble, semi-meuble, and meuble. Adaptive reuse of existing materials provided insight into connecting to existing elements that cannot be changed physically, like the walls or ground on a cavity, shown in the expanding modular cube-to-tetrahedron semi-meuble that molds around the outside walls of the cavity.

Construction

Furniture making provided to opportunity to learn practical building skills, familiarising oneself with workshop tools and techniques that informed construction of the building and its programme. The building was made transportable by its modular space frame construction system, which is economic to produce and easily resized to fit specific sites by adding or taking away tetrahedrons. The tetrahedrons are converted into cube shaped containers to transport the machines they house. The unfolding of the structure into a piece of architecture
is choreographed by a group of people by hand, like a barn raising, encouraging social capital. Those assembling the structure may not have the experience to build a complex piece of architecture, like myself, so simple solutions like weaving and screwing were employed to encourage community participation. Making as a design process ensured that if I (as someone with not much practical construction experience) was able to construct a detail, someone else of similar skill level could also do so. Design of a cyclic services system means the building can be constructed in any number of urban cavities, in addition to promoting environmental sustainability and resilience.

Designing a transportable building was decided at the beginning of the project, before the theory of semi-meuble was researched. Therefore the project started as a meuble object/building, but to put only a meuble object in an urban cavity does not solve the waste of space and creates ‘dead’ areas. This project would have perhaps had more impact if the scheme was built in permanently, not as a semi-meuble architecture that must be transportable.

Making provided insight into the time it takes to physically construct a design; it is much slower than a traditional design process, in which entire decisions can be made in seconds but take days to build. Design and testing of lighter and stronger material for the shear walls of the tetrahedrons was enabled by making. Without physically constructing these materials, their heaviness and tolerances would not have been able to be fully understood. Making informs understanding the nature of materials used, how they are connected, with what tools they are built and how elements of the building physically look or react to each other. I would recommend for other architects utilising making as a design process to perhaps start with less ambitious projects, perhaps simple restoration of existing chairs or furniture, that allows one to understand limits of both tools and ones own abilities.

It was found that like Wright or Aalto, a strong communication link between designer and field experts is necessary to make up for any lack of construction skills. It is more rewarding as a process with help of people more experienced in certain areas — builders, civil engineers, or services engineers. It is important to know how to communicate in their profession’s language than to be able to do all skills required to get the best results. Therefore it is proposed that this building creates an outlet for passing on tacit knowledge.

**Occupation of the Programme and Urban Cavity Space**

The semi-meuble wall system blends with existing cavity walls by leaving some tetrahedrons transparent, exposing the previous melancholy of the existing site. This semi-meuble wall also blends with the roof structure, which also contains services — by melding the semi-meuble
with immeuble architecture it is hard to tell if the building is a cupboard containing tools, or shelves exhibiting furniture, or is simply a wall and ceiling. In essence, the architecture is all of these things. This creates a space that is able to maintain its efficiency, aesthetic and functionality in the long term, avoiding fit out decisions compromising a spatial intention by with a contradicting fit out.

The semi-meuble wall system fits against the outside of the cavity, allowing for a large open space in which the meuble inhabits and creates smaller spaces. The cross bar gesture on the back of the meuble table creates safe barriers to the surrounding machines, and smaller spaces to create a feeling of intimacy. By making meuble chairs, I was able to research the chair objects that are to occupy the semi-meuble tetrahedrons. By also using the tools to be housed in the semi-meuble, individual requirements for each programme were recognised and allowed for architecturally. Examples include movement of tools for easier access (enabled by the drawer tetrahedron unit), or the lighting levels needed (provided by the translucent fabric walls).

Short term occupation of the sites meant that a sense of place might be lacking. The Meuble Making Studio combats this by being an event. The community assembly of the architecture, and its kinetics result in a building that can hold interest even when one is not there to make. This kinetic aspect is created by the drawer units, moving ramps and floors, and film screens that turn the structure into a theatre.

Summary

The skills, values and knowledge that have been improved by this research method include practical skills of tools and construction methods, and these learnings have been highlighted in the design of the workshop and the detailing. The knowledge I have gained concerns the history of furniture making, and the importance of meuble and semi-meuble in the ability to change architecture’s spatial constructs. The values gained centre on social and environmental sustainability — the communities’ involvement in the construction and ownership of the building is crucial, and if successful, will have positive affect in the short and long term. The large open space and arrangement of meuble within the space encourages dialogue and interaction amongst a community who otherwise may not meet on a one to one basis. This building provides a space for people to make, and in turn people come to make the building.
Final chairs, as shown in presentation
Plan of site location, Galatos Street layout, Dacre Street layout and Halsey Street layout
Long sections of buildings as would be assembled on all three sites (Halsey Street, Dacre Street and Galatos Street)
Front elevation of Galatos Street
Front elevations of Halsey Street and Dacre Street
Perspective image of interior of set up on Dacre Street. Note the step up of the site.
1.50 Interior Scale Model of Structure, showing circulation unit and interior structure.
1.50 Interior Scale Model of Structure showing wall to roof connection.


LIST OF FIGURES

Fig. 2: Tea Drinking Chair frame having its paint scraped back
Fig. 2.1: Design process diagram
Fig. 2.2: Meuble Making Studio aims and objectives diagram
Fig. 3: Charles and Ray Eames - cinesourcemagazine.com/images/uploads/10_11_Cvr1_MillValley_ph1
Fig. 3.1: Images of architect designed chairs - Vitra Design Museum, 100 Masterpieces from the Vitra Design Museum Collection, with the exception of Hadid’s Serif Chair - http://www.dezeen.com/2006/12/07/zaha-hadid-furniture-exhibited-in-new-york/
Fig 3.2: Diagram of the Meuble in Wright’s Fallingwater - Christopher Little, The Wright Style, By Carla Lind.
Fig 3.3: Wright’s The Lovness Studio dining table with high backed chairs - Lind, Carla. Frank Lloyd Wright’s Furnishings. San Francisco: Pomegranate Artbooks, 1995.
Fig 3.4: Meuble Furniture Micro Categories - Vitra Design Museum, 100 Masterpieces from the Vitra Design Museum Collection.
Fig 3.5: The semi-meuble furniture of the Lovell Beach House - Die Neue Raumkunyz in Europa und Amerika, by Herbert Hoffmann, Julius Hoffmann Verlag. Original courtesy of the UC Santa Barbara, University Art Museum, R. M. Schindler Collection. Photograph taken by Edward Weston.
Fig. 3.6: Reitveld’s Red and Blue Chair - http://www.design-museum.de/en/exhibitions/detailseiten/gerrit-rietveld.html
Fig. 3.8: Diagram comparing Fallingwater exterior to an interior built-in semi-meuble desk. Desk image - fallingwater.org/explore?to=1 and exterior image - franklinlloydwright.com/famous-worksfalling-water-an-architectural-legacy
Fig 3.9: Breuer’s By Wassily Chair - design-museum.de/en/collection/100-masterpieces/detailseiten/b3wassily-marcel-breuer.html.
Fig. 3.10: Aalto’s Paimo Chair - Aalto, Alvar, Aino Aalto, Thomas Kellein, and Kunsthalle Bielefeld. Alvar & Aino Aalto : Design : Collection Bischofsberger. Original Photograph taken by Nic Tenwiggenhorn.
Fig. 3.11: The Eames House in California - www.archdaily.com/66302/ad-classics-eames-house-charles-and-ray-eames/stephentryon3/
Fig. 3.12: The Eames ESU Cabinet - osoriosilva.com/homespace/?p=18
Fig. 3.13: Hadid’s Serif Chair - http://www.dezeen.com/2006/12/07/zaha-hadid-furniture-exhibited-in-new-york/
Fig. 3.14: Hadid’s Hotel Puerta America - Zaha Hadid; Zaha Hadid.
Fig. 3.15: Holl’s NYU Philosophy Building - www.stevenholl.com/project-detail.php?type=educational&id=21&page=0
Fig. 3.16: Holl’s Riddled Cabinet - http://www.stevenholl.com/project-detail.php?type=productdesign&id=91&page=0
Fig. 3.17: Manupipatpong’s ‘Space Between’ - http://www.dezeen.com/2009/07/15/xs-architecture-vs-xl-furniture-by-worapong-manupipatpong/
Fig. 3.18 - Manupipatpong’s ‘Shelter of Nostalgia’ - http://www.dezeen.com/2012/08/01/shelter-of-nostalgia-by-worapong-manupipatpong/.
Fig. 4: Fire escape in the Galatos Street Site
Fig. 4.1: Diagram of the research method process
Fig. 4.2: Diagram of the lineal design process
Fig. 4.3: Diagram of the circular design process
Fig. 4.4: Map of the urban cavities in Auckland CBD. Original map taken from Auckland Council’s ALGGI Map Generator
Fig. 4.5: Typical urban room types
Fig. 4.6: Atypical urban room types
Fig. 4.7: Galatos Street, Dacre Street and Halsey Street Sun Path Studies
Fig. 4.8: Galatos Street Site Images and site axonometric as an immeuble ‘room’
Fig. 4.9: Image of Galatos Street urban cavity on Auckland Map (taken from ALGGI)
Fig. 4.10: Site Photos of Halsey Street and site axonometric as an immeuble ‘room’
Fig. 4.11: Aerial View of Halsey Street, map image originally taken from ALGGI Map Generator
Fig. 4.12: Image of Dacre Street urban cavity on Auckland Map (taken from ALGGI) and photographs of site and Dacre Street site photographs and site axonometric as an immeuble ‘room’
Fig. 4.13: Photographs and design sketches of the first ‘Blanket Chair’
Fig. 4.14: Sketches of Blanket Chair into an architectural scale
Fig. 4.15: Second incarnation of the Blanket Chair
Fig. 4.16: Photographs of scaled site models with Blanket concept
Fig. 4.17: Meuble Making studio diagram
Fig. 4.18: Tea Drinkers Chair models, sketches and final chair
Fig. 4.19: Sketches and collages of chair into concept, and model of cube opening
Fig. 4.20: Opening cube concept tested in site
Fig. 4.21: Chipboard model of tetrahedron cube concept
Fig. 4.22: Perspectival Photoshop collage of the tetrahedron concept in the Galatos Street Site
Fig. 4.23: Perspectival Image of the building concept on Dacre Street Site
Fig. 4.24: Plans of the tetrahedron concept on Galatos street
Fig. 4.25: Sketch of the making process as an event
Fig. 4.26: Model of the tensile roof concept
Fig. 4.27: Schematic Diagram of the building’s structure and services
Fig. 4.28: Development of layout and second floor system
Fig. 4.29: Photographs of model of layout of the tetrahedrons
Fig. 4.30: Long perspective section of the programmes of the semi-meuble
Fig. 4.31: Short Perspective section of the programmes and light shafts of the semi-meuble
Fig. 4.32: The drawer unit section diagram and a model of the drawer unit
Fig. 4.33 - Space frame roof development
Fig. 4.34 - Prior iterations of the assembly performance.
Fig. 4.35 - Assembly of roof structure
Fig. 4.36: The Wool Chair
Fig. 4.37: Design process of the meuble workshop table
Fig. 4.38: Images of vertical circulation development
Fig. 4.39: Image of horizontal circulation development
Fig. 4.40: Schematic of the Philip Microbial System - www.designboom.com/weblog/cat/8/view/17397/philips-eco-friendly-microbial-home.html
Fig. 4.41: Image of the Philips Microbial home set up - www.design.philips.com/philips/shared/assets/design_assets/images/probes/microbial_home/mh_hr1
Fig. 4.42: Diagrams of the Solarnext laminated photovoltaic fabric - solarnext.eu/eng/env/pvflexibles.shtml
Fig. 4.43: Schematic of the Meuble Making Studio’s services
Fig. 4.44: samples of material investigation
Fig. 4.45: development of tetrahedron joint
Fig. 5: Drill creating hole in a piece of chipboard
Fig. 5.1: Assembly of the Tetrahedron connection joint
Fig. 6: Image of the Noun 1- Unavailability folly - gartnerfuglen.files.wordpress.com/2012/02/41.jpg
Fig. 6.1: The Spacebuster New York - http://www.raumlabor.net/?p=1799
Fig. 6.2: The Noun One Unavailability Folly - http://www.dezeen.com/2012/03/04/noun-1-unavailability-by-gartnerfuglen/#more-196608
Fig. 6.3: Archigram’s Blow Up Village Assembly process - http://archigram.westminster.ac.uk/project.php?id=89
Fig. 6.4: The Bucky Lab’s mobile workshop - http://buckylab.blogspot.co.nz/p/the-mobile-workshop.html
Fig. 6.5: The East London Furniture Company’s Workshop - http://eastlondonfurniture.co.uk/
Fig. 6.6: Photographs of ‘the making’ of the chairs
Fig. 6.7: Photographs of ‘The making’ of the chairs
Fig. 6.8: photographs of the Dacre Street site
Fig. 6.9: Photographs of the Galatos Street site
Fig. 6.10: Photographs of the Halsey Street site
Fig. 6.11: Noise levels of the machines to be used in the Meuble Making Studio (DBa levels taken from http://www.lowermanhattan.info/extras/pdf/062007_)
Figs. 6.12: - Wynyard Quarter Aerial Photos, original maps taken form Auckland Council’s ALGGI Map Generator
Fig 6.13: Halsey Street in 1931, image taken from Sir George Grey Special Collections, Auckland Libraries, 4-4002
Fig. 6.14: Dacre Street Aerial photos from 1940 - 2008,
   6.15: Image of Dacre Street site taken in late 1880s - early 1900’s, taken from Sir George Grey Special Collections, Auckland Libraries, 4-1008’
Fig. 6.16: Galatos Street Evolution
Fig. 6.17: Las Vegas and T and T Children’s Wear, 1989, image taken from Auckland Museum, ref. RMS/cACS40/545

Fig. 6.18: Development of roof structure

Fig. 6.19: Development of roof structure

Fig. 6.20: Sainsbury Art Centre structural diagram - http://www.greatbuildings.com/cgi-bin/gbc-drawing.cgi/Sainsbury_Centre.html/Sainsbury_Centre_Det_2.gbd

Fig. 6.21: British Pavilion space frame - http://grimshaw-architects.com/project/british-pavilion-expo/

Fig. 6.22 - Development of tetrahedron programme
APPENDICES

TEXT AND IMAGES
IN ADDITION TO MAIN DOCUMENT

Fig. 6
One can dwell in a chair just as much as in a building. A building can wander, and be an event (like a circus) and still feel like the same dwelling or place. Edward Relph, in Place and Placelessness, 1976 wrote:

“Location or position is neither a necessary nor a sufficient condition of place, even if it is a very common condition. This is of considerable importance for it demonstrates that mobility or nomadism do not preclude an attachment to place.”

When analysing mobile buildings a pattern emerges as architecture as an event or image as well as form. From analysing the successful structures and theories of Cedric Price’s Transportable Environments: Theory, Context, Design, and Technology, it seems the ‘arrival’ of something seemingly so static as a building naturally draws curiosity, allowing the nomadic buildings to relate very heavily to time and life-span. New York City’s The Spacebuster, by Raumlabor Architects in Berlin, performs its entrance by firstly arriving inconspicuously as a

---

step van. It proceeds to expand by filling with air as a large plastic bubble to fill urban cavities. The constant injection of air into the structure creates a sense of activity and biomimicry - it is alive, breathing moving and finite in life span. The structure is eventually let out of air, deflating and packed up. The event of its entrance, existence and demise naturally attracts curiosity because of action, construction and performance. The structural system is simply by hydraulics, which also acts as its weather-skin.

Noun 1- Unavailability, a small folly by architects Gartnerfuglen, Norway, performs an entrance and exit that constitutes an event. The semi-modular timber structural system is assembled quickly by two people, framing a fine grained chicken-wire mesh. Built in freezing climates, water is then dripped, naturally or otherwise, down the chicken wire, forming ice sheets between the structural members. This encloses the space, forming a sort of igloo. Lit up at night, it creates a small lantern in a frozen tundra, performing beautifully during it’s life-stage. This performance is completed at the end of winter, when the ice gradually melts off, freeing the structure to move elsewhere. It is hard to believe one could accuse this mobile structure of not relating to context when its poetry so heavily relies and celebrates its immediate environment. The structural system of stiff members is much less simple than the Spacebuster, as well as less flexible.
Transitory buildings must be somewhat flexible in their structure, “as their design is based on a new range of environmental and technological issues that must, as always, take account of human sensibilities.”

Blow Up Village by Archigram is a portable village, with telescope like structure that supports a blow up skin around it. The event in this case is the arrival of a very conspicuous hovercraft, illustrated in the first image. Through a hydraulic pressure, the main mast in the centre then lifts, followed by the arms that support each pod. This forms a series of layers— the weather skin, the structural arms, then each pod’s skin. Circulation is by way of ramps. It seems that the skin, although movable is the immeuble, the pods the semi-meuble and the furniture within the meuble. This method of solid structure with air pressured skin is a combination of the other two portable precedents.

Mobile workshops range in precedent from trailers, to trucks, to tents. The ‘Bucky Lab’ Project is a university workshop, designed to be mobile around campus. Housed in a tent like structure, several furniture units were developed to house tools from one location to the other. It would most likely be quite hard to fit in another cavity space, as the trusses are not variable. The tools are simply set up on tables inside the open space.
Chance meetings of local residents may occur within the structure, as people participate in making, watching films, furniture re-invigoration or other events held in the structure. The positive benefits are referred to as ‘Social Capital,’ gained through residents ‘making’ together as a group. This creates social sustainability. Social Capital is the resources and feelings catalysed by positive co-operative group action — the feeling of community and the ability to achieve more than one would individually. The capital is created when a group of people co-operate, trust each other, and is owned by the group rather than the individual. It creates “networks, reciprocity, trust, shared norms and social agency”\(^4\). The interactions need to be voluntary rather than forced, but can be either inadvertently arrived at or through conscious planning, such as the proposed project.

My own experience working in the university workshops during this project whilst making furniture has resulted in much social capital- from casual conversations with other year level students, to workshop technicians recommending books relating to my project. This has resulted in knowledge, relationships and physical resources swapped or gifted, that otherwise would have not been gained.

Suggested ways Social Capital could affect the surrounding areas of the proposed structure are based on Rosemary Leonard and Jenny Onyx’s social capital benefits:

- A tighter sense of community and belonging in an area about to go through the process of gentrification.
- A community, now aided with an appreciation for design and craftsmanship, watching over future development in the vacant site.
- A community that now looks out for one another – the traditional concept of knowing ones neighbour, not often practiced in the fairly anonymous Auckland CBD.
- Lower crime rates, higher productivity and economic development. \(^4\)

Possible deterrents to creating Social Capital within the project could be a lack of chance meetings, or utilisation of the space at different times by different people- for example, a group of young people participating after work, to an older self-employed person taking a break one morning. Perhaps the participants may also realise one cannot trust ones neighbour, or that one has no mutual interests. This situation may be a useful realisation however in ones


\[^{42}\] Ibid, 3.
belonging or expectations of a certain area, such as the Karangahape Road precinct.

Company East London Furniture Factory (Fig. 6.5) creates furniture from discarded materials found around its workshops, such as pallet crates and aborist waste. The waste material is turned into beautiful design objects, in workshops to the rear of the retail spaces to sell them. The workshops themselves are mobile, moving into unused retail spaces around London until they are tenanted. They refer to this practice as upcycling property as well as upcycling material, diverting waste from landfill. The business is extremely successful, and manages to combine an environmental ethos with viable employment. Using re-purposed materials brings up issues around the restriction of limited resources. Architects must come to terms with not only using certain products, but being able to only use certain amounts of products.

This research project does not look to replicate an arts and crafts movement, rejecting industrial process and mass made design. The steady decline of natural resources in the world means we do not have the supply or manpower to reasonably expect to do so with such a large population that is ever expanding. This research project focuses on a movement to personalize existing mass produced objects that would otherwise be discarded and replaced, tapping out our limited resources.

Albert Einstein said “we can’t solve problems by using the same kind of thinking we used when we created them.” This reflects on those who create ‘green’ architecture or furniture that responds to a global resource crisis by manufacturing new products, such as cladding, services or structure, when we have an excess of abandoned structures and products filling landfills. The process of making one’s own furniture is enlightening in terms of resource use. It is especially relevant in this project as one is working in spaces that are already defined and existing. These techniques can be translated from architecture to urban scale. The positives of creating social capital through this project are immense. It will result in a positive effect from the structure’s existence even after the structure has moved on, in addition to the objects created in it.

APPENDIX THREE:
THE ‘MAKING’ PROCESS

Fig. 6.6 - The tools, process and techniques utilised in making of the chairs
Fig. 6.7 - The making of the chairs
APPENDIX FOUR:
DACRE STREET
SITE PHOTOGRAPHS

Fig. 6.8 photographs of the Dacre Street site
GALATOS STREET
SITE PHOTOGRAPHS

Fig. 6.9 Photographs of the Galatos Street site
HALSEY STREET
SITE PHOTOGRAPHS

Fig. 6.10 Photographs of the Halsey Street site
APPENDIX FIVE:
NOISE ISSUES

1 in 5 people exposed regularly to 90 decibels will lose some hearing\(^{42}\). Excessive noise levels will also cause irritation to neighbours.

The L\(_{10}\) bylaw outlines however that noise levels may be exceeded for 10 per cent of the time one is constructing. Auckland Council describes that “for example *L\(_{10}\) 75 dBA means that over a 30 minutes period, the noise may only go above 75 dBA for 3 minutes.”\(^{43}\)

When assessing the noise levels of the type of equipment being used however, it is apparent that keeping within these levels will be difficult.

The low allowable levels mean that in most tools will not be permitted for use for extended amounts of time in the open air. This means a substantial amount of sound proofing needs to take place in the structure. The current surrounding uses of the sites however, being large offices or live music (excluding Halsey’s light industrial and the residential uses) mean that noise allowances for excess will already be in place. This indicates that perhaps the surrounding residents are willing to forgo the noise barriers or perhaps the buildings are well insulated. Saturday limits are slightly higher, and allow the use of small manual machinery and tools for an extended amount of time. Saturdays and Sundays are possibly the peak use time for the structure; when people are not at work and have more free time for individual pursuits and hobbies. Noise on a Sunday is not permissible outside of the CBD however, and is very low in the CBD. The temporary nature of the structure means that a particularly difficult neighbourhood to work in, with sensitive neighbours or high echo rates, could be vacated at a quicker rate.

---


Fig. 6.11 Noise levels of the machines to be used in the Meuble Making Studio. 
(DBa levels taken from http://www.lowermanhattan.info/extras/pdf/062007_/)
APPENDIX SIX:
HALSEY STREET:
HISTORY, CONTEXT & FUTURE

In 1950, the petroleum tanks to the west of the site were in full use. Remnants from these tanks still pollute the site. The site was occupied by a possibly industrial structure encompassing the neighbouring sites in the 1950s. This was demolished between 1974-1996, and is now used as a car park. The car park services restaurants and office buildings to the north, as well as other neighbouring properties. The large apartment building to the east was constructed in the 2000s, replacing the marine industrial structures seen in 2001.

The Quarter was mainly industrial zoned and the development of large silos provided the nickname “Tank Farm.” These silos held toxic products. They are currently being cleaned for the redevelopment.

The penthouse apartment of the complex across from the site was sold for the highest amount/ m² in New Zealand history. This indicates that the real estate potential of the site is much more of its current state. Recent Waterfront Auckland press releases indicate the possibility of a canal being placed through out the site. This use will enable 100 year flood to pass through the quarter much easier, and provide a visual amenity for the future residents of the surrounding proposed buildings. The council height limit for the site is 25m.
DACRE STREET: HISTORIY, CONTEXT & FUTURE

Dacre Street was once only a few blocks away from Galatos Street, until the 1969 north-western motorway development cut it off. The aerial photographs above show the change from the residential use to heavily industrial, with the addition of the motorway. The images show a traditional villa type residential building originally on the site, which was made into a cavity during the motorway construction.

Council rates indicate that the capital value is $2.45 million, although this includes the entire legal boundary, which wraps around onto Upper Queen Street. There are 13 car parks on the site.

In the Auckland Council 2040 Draft Plan it is projected that the land owners of Newton will need to develop 750,000m² of residential floor area, 320,000m² of commercial floor area, at a total of 1,070,000m² total net floor area. At an average cost of construction ($2000/m²), that is $2,140,000,000 worth of development that is to take place in these missing teeth and terrain vague areas of Newton. If an even amount of development was to occur every year from now until the projected 2040 (28 years), that is a annual spend of $76,428,571/annum just in the Newton Gully area alone. The council’s figures are an extremely optimistic projection. When the last buildings are to be developed, many of the first structures to be built will be approaching their 40 year life spans, which will create a whole new set of missing teeth to house the proposed structure.
The site has been a cavity since as easily as the 1940’s- an imprint from a previous one storey building can be seen on the eastern walls, possibly demolished when the building to the north was constructed in 1912. The gentle fade of scale and use was destroyed by the construction of the North-Western motorway in 1969, turning the area into a semi-industrial area. This was combined with the fading of Karangahape Road’ fall from a distinguished shopping district to a red light zone. The image of 1974 shows the extreme amount of earth that was moved for the motorway, meters away from the site. The 1989 image shows the decline into a red light district that Karangahape Road and Galatos Street faced- this picture takes place directly across from the building to the north of the site. ‘Las Vegas Striptease’ moves in next to ‘T & T Cheaper Childrenswear,’ obviously creating an uncomfortable situation, in which mixed use is not always preferred. Las Vegas Strip Tease still remains on Karangahape Road in 2012. In 2001 the motorways prosper and grow, as cars gained prevalence, almost completely over public transport. There are cars parked on Galatos Street for the first time in an aerial photograph.

Auckland Council’s Draft 2040 Plan indicates Karangahape Road is expected to have growth at an extra 46,000m² commercial property, 77,000m² residential property, and 3000m² civic/arts spaces which equals a total of 126,000m² total net additional floor area. These figures indicate that at a current average rate of construction ($2000/m²) it will cost $252,000,000 to develop to capacity. Over the span of the plan (28 years) this will cost $9,000,000/annum. The current economic market may not allow for site owners to invest capital for some time, providing opportunity for temporary structures that bring the area to capacity for less capital. The council has also proposed a shift from the current 15m height limit to 30m.
APPENDIX SEVEN:
DEVELOPED DESIGN:
ROOF STRUCTURE

The options above were explored through CAD and physical modelling.

1. A folding motion to create strength and scatter light — by making in the workshop, it was found light was best when non-direct, achieved with the folding of transparent membrane.

2. This combined with the original tensioned cable system, putting ETFE membrane between the tensile wire. The structural issues still remained however, and also how to attach a membrane to the wire.

3. and 4. Looked at pulling down the wire structure with weights in the centre, in a folding motion then in a flat butterfly sheet. Criticism of this concept was that it simply looked attached to the semi-meuble, that it didn’t look very permanent or strong. Also, ETFE membrane requires much more support than this.

5. An inflated structure that attached over the top of the cavity was tested. This also didn’t look semi-meuble or immeuble. The inflation looked too much like a very impermanent
meuble object separated from the walls, like the previous concepts. Therefore this design really needs to gesture to a sense of permanence even if the structure is not.

6. A space frame structure that took cues from the semi-meuble walls was tested. This was deemed most successful as it helped to blend the wall and ceiling planes, like in Schindler’s semi-meuble architecture. The space frame system developed can be changed in span from site to site, prisms are simply added or taken away.

Several precedents provide basis for this structure. Norman Foster’s 1977 Sainsbury Art centre contains all services within the space frame also. The structure is made of hollow welded steel tubes, and centred at 3.6 spacings. The clear span is 28.8 metres, with a stud height of 7.2m.¹

---

Nicholas Grimshaw’s 1992 British Pavilion at the Seville Expo has a space frame roof that has a clear span of 32 metres. It consists of tubular steel roof trusses pin-jointed onto trussed steel. Grimshaw’s pavilion also contains a wall lined with shipping containers that store water for use in the building. The use of water at the base of the space frame provides cooling for the glass on the outside of the building.

Similar water pools have been included in my own design; in order to store storm water, which is the heaviest of storage needs, as well as collect stray sawdust particles from the machines. It also provides reflection to the bottom of the structure, showing viewers of the building exactly how it is constructed from every angle. It also provides a guttering system, catching water from the light shafts and preventing it from flooding the site.\textsuperscript{45}

These projects utilised tubular steel profiles and are intended as permanent structures. Angle shaped profiles were chosen for this project because of their ability to run services down them and expose them, emphasising exactly how this building is made and works. This is important to expose in order to appreciate the mobile nature of the structure and compare it to their own craft and making.

Several other tetrahedron programmes were explored in further detail to ensure the system worked well. The vegetable garden unit required detailing to ensure watertightness and that plants could actually grow in the space. The section above, detailed with help from landscape designer James Walkinshaw, explains the elements needed to ensure the vegetables are stable when being transported and are able to grow.

Fig. 6.22 explores possibilities for the living units of the technicians. This was developed from being units that were interspersed with the rest of the structure, to sitting at the back of the unit. These quick plan drawings show how the services schematic, detailed at the end of this section, might look incorporated with the architecture. These units are suggested as temporary living situations, if the technicians are too far from home in a temporary location.

APPENDIX EIGHT: DESIGN PROCESS: PROGRAMME DETAILING

Shallow Root Vegetables
Aluminium hinged flashing
Fertilised Growing Medium
Aluminium holding tray
Loose fill
Damp Proof Membrane
Polyurethane, MDF and Plywood sandwich panel

Fig. 6.22 - Development of tetrahedron programme