DRAWING IN THE DOMAIN

*Paraparaumu, Kapiti District
New Zealand*

DRAWING IN THE DOMAIN

*An investigation into the dialogue between analogue and digital tools
through the design of a Paraparaumu sports clubrooms*

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Figure 1. New Zealand with the Wellington Region highlighted.

Figure 2. Wellington Region with the Kapiti District highlighted. The area shaded in black is the area of interest near Kapiti Island, about 50km from Wellington.

Abstract

Tourism in New Zealand is often about nature. On the Kapiti Coast, tourism is preoccupied with the island, but this research looks at possibilities of cultural tourism in Paraparaumu township: away from risks of coastal erosion, sea level rise, and potential tsunamis. Sport is important to local culture and the objective is to explore the architectural potential for the Paraparaumu Domain. The existing Paraparaumu Rugby Club, Old Boys Cricket Club, Athletics Club, and Memorial Hall are all in separate buildings, used at separate times, during different parts of the year.

What kind of architecture could help celebrate local sports culture? What kind of processes might be cultivated through such a project and how could they influence the design?

Through the design of a shared sports clubrooms in the domain I searched for design processes and typological hybrids that could both connect to the local cultures, but also to discover more complex technical and spatial possibilities. Beginning with a typical cement block I explored an interior quality of the existing clubrooms; one that is unpretentious and modest. I experimented with analogue and digital processes to draw out a relationship between qualities, thinking how blunt instruments can come together with more sophisticated ones.

Acknowledgements

To my grandparents with us or not, thank you for the inspiration.

To my family, thank you for support.

To my supervisor Sam, thank you for mentoring.

To my friends, thank you. The amount of pests, battlers and intelligence in the cohort is extraordinary. You know who you are.

On previous page:

Figure 3. Early model of a sports changing room at 1:20

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Scope of research

The scope of this research is to explore what kind of design processes might be cultivated through the design of a sports clubhouse in the Paraparaumu Domain. This research investigates architectural design processes, predominantly the relationship between analogue and digital tools, and considers how these could influence design development.

The tools used are those readily available to an architecture student. Pens, pencils, butter paper, cartridge paper, alongside computer programs Adobe Illustrator and Grasshopper were used in this research.

The research is limited to analysis of design experiments conducted while designing a Paraparaumu Clubhouse. The research is drawn from these experiments and presented in this Research Portfolio.

Introduction

This research document is divided into eight chapters.

Context

Chapter One introduces the context in Paraparaumu, briefly covering tourism, local culture and observations.

Chapter Two introduces the design; The Paraparaumu Clubhouse. It describes the building in relation to its context.

* * *

Process

Chapter Three describes early design experiments and reveals 'The Incident'; a turning point in the design process. Here a '*Dialogue between Blunt and Sharp*' is formed to explore the relationship between analogue and digital tools in more detail.

Chapter Four, Five and Six cover further design experiments using different pens, pencils, papers and computer programmes. These experiments are analysed in relation to the dialogue to reveal influences on the design.

* * *

Discussion

Chapter Seven positions the Paraparaumu Clubhouse against existing work regarding tectonics, structural systems, composition and geometry.

Chapter Eight discusses the '*Dialogue between Blunt and Sharp*' in relation to existing theory. The discussion considers '*The Craftsman*' by Richard Sennett and '*The Thinking Hand*' by Juhani Pallasmaa as key texts.

* * *

Chapter Nine closes with a summary of findings and future research opportunities.

KAPITI
ISLAND

PEKA PEKA

WAIKANAE
BEACH

PARAPARAUMU
BEACH

RAUMATI
BEACH

RAUMATI
SOUTH

PARAPARAUMU

PAEKAKARIKI

PROLOGUE

Context: Chapter 1

Figure 4. The settlement lies on the flat land between the hills and the coast.

Key:

- Train Station
- Train Line
- Main Road
- Expressway (opened Feb. 2017)
- Expressway off-ramp
- Tourist Attraction
- Site: Paraparaumu Domain
- Sports fields

Tourism in the Kapiti District

In New Zealand tourism is orientated toward nature and in the Kapiti District tourism is orientated toward Kapiti Island. The Settling Regional Landscapes research stream was tasked to design a bio-security and visitor centre for this island. I decided however to focus on the potential of cultural tourism in Paraparaumu Town; away from risks of coastal erosion, sea level rise, and potential tsunamis.

The new Kapiti Expressway opened in early 2017 cuts Paraparaumu Town off from the coastline, diverting economic activity away from the township. This however opens an opportunity for Paraparaumu Town to develop its own character through events and local activities.

Figure 6. The Kapiti Expressway cuts through the District

Figure 7. The beach and Kapiti Island as viewed from Raumati South

Left:
Figure 5. Tourism and Parks in the Kapiti Region

KAPITI
ISLAND

WAIKANAE
BEACH

1

WAIKANAE

PARAPARAUMU
BEACH

RAUMATI
BEACH

RAUMATI
SOUTH

PARAPARAUMU

1

4

Local Culture

A key part of local culture in the Kapiti District are clubs. Clubs range from the leisurely to the competitive, however most are related to a sport in some way.

This design looks to build on an existing network of clubs and people in the Paraparaumu Domain (highlighted in red). With close proximity to town and a train station it serves as a solid foundation to support local festivals and sporting events.

Left:
Figure 8. Clubs in the Kapiti District, area of interest outlined in a grey box

Figure 9. Paraparaumu Rugby Football Team ,1927

Figure 10. Kapiti Pony Club, 1988

Figure 11. Paraparaumu Bowling Club, 1981

Figure 12. Preparing to go sailing, Kapiti Boating Club

KAPITI EXPRESSWAY

Paraparaumu Town

Until early 2017 Paraparaumu Town had the main highway running through it. The town centre is predominantly commercial big-box retail and drive-through fast food chains. The residential surroundings are low density, typical of regional New Zealand.

As part of site analysis I spent a week working in Raumati South for a local. I visited the Domain and town regularly and made my own observations in that time. These observations have influenced the design of the Paraparaumu Clubhouse but considering the scope of this Research Portfolio they are omitted.

Left:

Figure 13. Aerial image showing Paraparaumu Township

Paraparaumu Domain

The Paraparaumu Domain is surrounded by mostly residential buildings. The domain is a social precinct of sorts containing a youth centre, memorial hall, child care centre alongside the Rugby, Cricket, Athletics and Pétanque clubs. A wide range of different people use the domain.

I decided to focus specifically on the Rugby Clubrooms, the Cricket/Athletics Clubrooms and the Memorial Hall. Catering for seasonal sports these buildings are often empty during parts of the year and times of the day.

Key:

1. Paraparaumu Memorial Hall
2. Rugby Clubrooms
3. Cricket/ Athletic Clubrooms
4. Pentaque Clubrooms

5. Cricket Field
6. Rugby Field
7. Kapiti Youth Support
8. Child Care Centre

9. Small Business
10. Auto Services
11. Community Church

Left:

Figure 14. Existing site plan, scale 1:2500

Figure 15. Rugby Clubrooms from the car park

Figure 16. Rugby field on game day

Figure 17. Rugby clubrooms

Figure 18. Cricket/ Athletic clubrooms

Proposed situation

The proposed design (the Paraparaumu Clubhouse) combines the Memorial Hall with the Rugby club and the Cricket/Athletic clubs. It aims to be a platform for community activity, linking sports clubs with the memorial hall users and the wider community. Car parks are shifted to the bottom of the domain.

Key:

- 1. Clubhouse providing for Rugby, Cricket, Athletics and Memorial Hall*
- 2. Car park*
- 3. Shifted Petanque court*
- 4. Petanque Clubrooms*
- 5. Cricket Field*
- 6. Rugby Field*
- 7. Kapiti Youth Support*
- 8. Child Care Centre*
- 9. Small Business*
- 10. Auto Services*
- 11. Community Church*

Left:

Figure 19. Proposed site plan, scale 1:2500

THE DESIGN

Paraparaumu Clubhouse

Context: Chapter 2

Figure 20. Early changing room plan 1:20 at A2

1. Hall
2. Bar
3. Memorabilia hallway
4. Kitchen
5. Bathroom
6. Changing Room
7. Referee's change
8. Storage
9. Viewing structures
10. Pétanque Courts
11. Cricket Field
12. Rugby Field
13. Turning circle

The Paraparaumu Clubhouse

Planning

The building consists of two main hall, each with their own bar, linked together by a memorabilia colonnade. Between the halls are shared amenities; kitchen, toilets and a meeting room. Trees help enclose the outdoor space around the building. The changing rooms have shared bathrooms. The geometries are all irregular shaped.

The outdoor walkway links the two fields together with wetland planting spaced in between. Vehicle access to the building is via a drop-off zone with limited car parking.

Left:

Figure 21. Ground floor plan

Figure 22. View out across a wetland to the cricket field

Figure 23. Cross section

Section

The section is composed of different connected catenary structures. The interior is predominantly brick with arch like openings in-between spaces and as a windows.

Skylights allow light to enter from above. In the changing room the catenary shape caters for various rituals that may occur prior to or after sporting events.

Figure 24. Longitudinal section

Figure 25. Early exterior perspective from rugby field

Figure 26. Interior of the Main Hall

Construction system

The design adopts a structural brick construction system based on freestanding vault structures. I expand on the construction system in Chapter 7.

Figure 27. Construction at the Mapungubwe Centre, Peter Rich Architects

Figure 28. Changing rooms section model at 1:20

THE INCIDENT IN THE STUDIO

Process: Chapter 3

Figure 29. A site plan iteration at 1:500, 11 July 2017

Figure 30. The inside of the changing rooms in the Paraparaumu Clubrooms

Introduction

Existing changing room typology

The cement block on the inside of the changing rooms is typical of sports clubrooms in New Zealand (figure 30). I saw this tectonic as a way to connect to the existing culture in the Paraparaumu Domain, but also as a foundation to explore more complex spatial possibilities and design processes.

Figure 31. Preliminary sketches looking a changing rooms and cement blocks, 20 March 2017

Figure 32. Isometric drawing of the changing room, 10 April 2017

Figure 33. Section drawing of the changing room testing different hatching techniques with ink pen and pencil, 10 April 2017

Experiments

Testing arrangements

In April I tested the spatial potential of the cement block through a changing room design.

I created a Grasshopper script on the computer that generates concrete blocks along a guideline (*refer to orange lines in figure 32*). I then attempted to create a 3D model of the changing room using the script.

The script behaved in an unusual way and produced a result I did not expect. I was trying to arrange the blocks somewhat evenly in a buildable manner but the result was a jagged array of blocks and a strange section. Admittedly I was not very skilled in this software at the time but it pointed to the fact that the digital tools architects use are not perfect.

Figure 34. Sequence of stacking laser cut bricks at 1:20, 10 May 2017

Model

In this experiment I looked to spatialise 'The Incident' changing room at 1:20.

I laser cut bricks and glued them in stacks aiming for a central point. As I laid each brick I tested spatial arrangements; thinking about how each one was laid in reference to the bricks below (*figure 34*).

I found that offsetting and twisting bricks created different shadows. The holes in the concrete blocks created unexpected dappled light on the interior (*figure 36*). 'The Incident' was a mistake but it led to formal and spatial opportunities I had not considered before.

Figure 35. Changing room exterior, 10 May 2017

Setting up a dialogue

'The Incident' shifted the way I thought about design processes. It revealed that computer programs are not always perfect and there was a disconnect between what I intended and what came out. It surprised me how much of an affect the computer process had on the design and I wanted to explore this in more detail.

It was here I established 'A Dialogue Between Blunt and Sharp' to explore the relationship between analogue and digital tools and consider how these could influence design development.

Figure 36. Changing room interior, 10 May 2017

CRICKET

PETANQUE

car parking.

stairs.
too large
1:200

A DIALOGUE BETWEEN BLUNT AND SHARP

Drawing experiments

Process: Chapter 4

Figure 37. A site plan iteration at 1:500, 11 July 2017

Figure 38. Building layers of design iterations on the light board is a key part of the design process

Introduction

How do I read this section?

The following chapters contain a series of experiments which are solving typical design problems (planning etc.) but also investigate this dialogue between analogue and digital tools. These two markers can be used to track both the design development and the dialogue development.

The pink markers track the evolution of the design

The green markers track the evolution of the dialogue between Blunt and Sharp as a process and its influence on the design

'A Dialogue between Blunt and Sharp' covers the relationship between the tools typically used by architects, analogue or digital. Pens, pencils, papers and computers are tested for their strengths and weaknesses in the design process. The design of a sports clubroom was used as a vehicle for this research.

Here the dialogue is working between a blunt pencil and malleable clay, introducing the pen to firm up areas and flesh out details

Figure 39. Working plan 1:200 at A3, 19 June 2017

Experiments

Clay to drawing

The aim of this experiment was to generate initial formal ideas for the site. I explored options by hand modelling with clay and used these models to help generate preliminary floor plans (*figure 40*).

Modelling with clay alongside drawing helped spatialise the plan and led to sketches on the side with isometrics, sections and details (*highlighted in red figure 39*). Pencil was good for testing ideas with pen good for firming up areas and fleshing out detail.

At the end of this experiment I had a building in my head but the drawing was messy and I found it hard to progress the design. It was decided to look for way to tidy up this process.

Figure 40. Early formal explorations of clay

At this point the design is using clay to determine the form while also thinking in plan about programme

Sharpening plans

While I could look at the drawing and visualise a building, my peers could not. In the working drawing I wanted to solve the whole building in one go which was tedious and slowed design progress. I let go of trying to solve the whole thing and committed to a large clear 1:200 plan.

The current state of the design process was sharpened by using a light board. I used 0.4mm ink pens to trace and draw detail at 1:200 such as doors and window openings.

The scale and use of ink pen forced me to think about detail which was good to crystallise the current state of design. This was successful at clarifying my design intent but I found it difficult to progress.

Starting to see the benefits of sharp tools such as ink pen as a way to crystallise current stages of design

Figure 41. The working plan using pencil and ink pens, 23 June 2017

Figure 42. The first sharpened plan using ink pen using 0.4mm ink pen, 25 June 2017

Approximation of programme

I found that 1:200 was a difficult scale to critique and felt locked in a current design state. In an act of frustration I looked for a way to progress.

To break free I scaled the plan to 1:500 then cut it into pieces of programme. These pieces of programme were approximated by hand creating irregular shaped geometries (*figure 44*). These were cut out and composed on the site plan at 1:500 (*figure 45*). At this point design and dialogue crossed paths for the first time; translating the imperfections of the hand drawn geometry into finite space.

Having bits of cut paper floating was rather messy and it was decided to use butter paper to continue the design process.

Design and dialogue crossed paths for the first time; translating the imperfections of the hand drawn geometry into finite space.

Figure 43. SANAA Rolex Centre Plan ,
Switzerland. (2010)

The design takes a turn from linked to separated spaces, although it would be naïve not to mention ‘flicking through’ SANAA’s plans around this time. I reflect more on this in Chapter 7.

Figure 44. Approximating programme. 07 July 2017

Figure 45. Arranging ‘cut-up’ spaces, 07 July 2017

Bookending

I developed a technique I refer to as 'Bookending' as a way to keep track of my design process. Although the process wanders with critiques and scribbles throughout, I found starting and finishing with a larger sharp plan was an effective way to organise it.

I began by scaling the sharp 1:200 plan (A) down to 1:500 (B) and critiqued it with a red ink pen. Often thinking had already begun as I was sharpening the previous plan (A) so it was important to critique sooner rather than later.

I continued with layers of butter paper, holding the pencil lightly to test ideas and slowly firming them up, introducing pen if needed. Butter paper allowed ideas to bleed and overlap forming a 'grey area' where ideas are being tossed around and tested. There were points when the butter paper became too blurry with information and another layer began.

Again, I sharpened the final plan (F) at 1:200 even if some things were still unresolved. This is an important process let go and crystallise the design to form a fresh foundation for the following experiments. I often found while sharpening the plan unforeseen ideas came to the forefront that were valuable for the next stage.

This process of working with both blunt and sharp was effective and continued the design process. However, it led to a neglect of section and elevation. As noted on plan (D):

"Logic is, get the plan right then others will come... wait... think about section. The actual heights"

At this moment these plan geometries were mere placeholders for form and it was decided explore them in section.

Figure 46. Plans arranged in a stack

Blunt and sharp becomes a way of working; pencil on butter paper lets ideas bleed and develop while ink pen on cartridge crystallises the current state of the design process

C

D

E

F

G

A4
1:500
Butter paper
Pencil, black and red ink pen
20 July 2017

A2
1:200
White cartridge paper
Black ink pen
21 July 2017

Improving circulation, program layout, and connections between spaces was a priority considering the multitude of parties involved. It was noted however that section was being neglected.

Figure 47. Plan B: Critique of sharp plan, 1:500 at A4, 17 July

Figure 48. Plan C: introducing a walkway, 1:500 at A4, 19 July

Figure 49. Plan D: Refining circulation, 1:500 at A4, 20 July

Figure 51. Plan F: Refining composition, 1:500 at A4, 20 July

Figure 52. Plan G: Final sharp plan, 1:200 at A2, 21 July

Introduction of section

I explored options for section and elevation with pen and pencil on butter paper at 1:200.

This process brought richness to the design as details, materiality and inhabitation were suddenly considered (*figure 53*). On reflection the iterations were relatively conservative and were only detailing the existing section or elevation. I drew these sections and elevations by tracing the plan and found this made it difficult to radically develop the form.

After the section tests I switched back to plan.

Through pen and pencil on butter paper I introduced detail to 1:200, however I found it hard to critique the form at this scale

Figure 54. Section development 1:200, 26 July 2017

Figure 56. Hand over a 1:200 plan at A2

Figure 55. Hand over a 1:500 plan at A4

Hand in relation to paper

During the '*Bookending*' process I discovered that there is a difference between working at 1:200 and at 1:500. In this specific case my hand could draw over the entire site plan at 1:500 in one motion without moving from its resting position. It made critiques and design moves far easier than at 1:200 which was large and difficult. In my opinion critiquing at 1:500 resulted in stronger spatial arrangements and a clearer formal language.

On reflection it would have been beneficial to explore what would happen with thicker pens, such as markers or highlighters. A thick marker is around 5 mm. This could make critiquing at different scales easier.

Digital tools refine the design's geometry and a non-hierarchical (or evenly spaced) logic guides the composition

Figure 57. Adobe Illustrator is introduced to refine geometries but also introduce a non-hierarchical composition logic, 10 Aug. 2017

Introducing the computer

In August I continued developing the plan through 'Bookending' but thought about how this process could interact with digital tools.

Using Adobe Illustrator I traced existing plans and created new forms with the mouse. I created 'Offsets' at 3m intervals and used these to guide the positioning of the other geometries (figure 57).

I noticed how this digital drawing was hard to re-work and I weaved it into the 'Bookending' process. I still used the hand on butter paper to critique and continue designing. Previously the geometries and composition had been handled manually using intuition, tracing with pencil and guiding the composition by eye. Now computer measurements guided the positioning and in my opinion these look sharper and more refined geometrically. The difference the computer made is evident in the comparison between figure 58 and 59.

An appreciation started to emerge for both analogue and digital tools. In August I developed a computer script which with the help of these digital drawings led to a 3D digital model.

Figure 58. Sharp plan before computer, 1:200 at A2, 21 July 2017

Figure 59. Sharp plan after computer, 1:200 at A2, 12 Aug. 2017

The dialogue here crosses analogue and digital tools for the first time, using the hand to critique and develop while the computer refines and organises

The design takes a turn from separated spaces to linked spaces, properly considering for the first time the opportunities in section.

Figure 62. A section from the digital model revealed conflicts in the design, namely the separation of spaces. 05 Sep. 2017

Figure 63. Blunt plan with section alongside 1:500 at A4, 07 Sep. 2017

Figure 60. Blunt sections 1:200 at A4, 12 Oct. 2017

Figure 61. Blunt section developing form and details 1:200 at A3, 16 Oct. 2017

Figure 64. Blunt plan and section 1:500 at A4, 12 Sep. 2017

Figure 65. Sharp plan after section developments, 1:200 at A2, 14 Sep. 2017

Figure 66. Blunt plan with section thinking 1:500 at A4, 06 Oct. 2017

Section experiments

In September the urgency for attention to section became apparent when I created a 3D digital model and cut through it on the computer. It revealed a stark relationship to the ground and weak in-between spaces. I found the separation of spaces problematic and I reflect more on why in Chapter 7.

This was the design's first proper development in section. In this experiment I used the 'Bookending' process but allowed sections and plans to emerge on the same piece of paper at 1:500.

This experiment was not as regimented as the previous exercises but was still successful in developing the section and plan. On reflection the larger sharp plans at 1:200 were messy and became hard to decipher. It would have been effective to be stricter with sharpening those final plans (*figure 65 and 67*).

Blunt and Sharp as a process opens to a new mode of working whereby plan and section are considered on the same drawing. Conceptualising the building in 3D was easier when I used a more fluid process; developing plan and section on the same page rather than one at a time

The following drawings on the next pages are scans of all sharp 1:200 plans in chronological order.

Figure 67. 2nd Sharp plan after section developments, 1:200 at A2, 16 Oct

Conceptualising the building in 3D was easier when I used a more fluid process; developing plan and section on the same page rather than just one at a time

Figure 68. Sharp plan (1) 1:200 at A2, 23 June 2017

Figure 69. Sharp plan (2) 1:200 at A2, 08 July 2017

Figure 70. Sharp plan (3) 1:200 at A2, 17 July 2017

Figure 71. Sharp plan (4) 1:200 at A2, 21 July 2017

Figure 73. Sharp plan (6) 1:200 at A2, 20 Aug. 2017

Figure 74. Sharp plan (7) - the first plan after properly designing in section - 1:200 at A2, 14 Sep. 2017

Figure 75. Sharp plan (6) - the final plan before the November reviews - 1:200 at A2, 16 Oct. 2017

A hand-drawn plan at 1:50

In preparation of the final review I embarked on a oversize A1 drawing of the building at 1:50. When beginning this process I was asked by colleagues: why are you doing this? Why not just Photoshop the bricks on the computer? I was aware that hand drawing would be time consuming but I wanted to convey the qualities of bricks and paving not possible at smaller scales like 1:200.

I began with a 0.05mm ink pen which I observed was too dark and precise so I switched to a 0.03mm (*figure 76*). At times I found the nib dried a little, enabling me to scratch the paper and create a half tone outline (*figure 77*). After some time I only drew a portion of the outline and let the mind make up the rest (*figure 78*). These different techniques were used to show the wear and tear that could happen after time.

Ironically the whole plan was never completed however during this process I thought a lot about what I was drawing. Hand drawing got me thinking about materiality, wear and tear, and how a labourer might lay the bricks. Where were the hot spots in the design, the entrances and key circulation paths? It was only through hand-drawing that these thoughts occurred and I discuss this in more detail in Chapter 8.

Figure 76. Initial brick drawing 0.05mm

Figure 77. Dried nib allow scratching to get half tone lines 0.03mm

Figure 78. Drawing parts of the brick lets the mind complete the rest 0.03mm

Figure 79. Hand-drawn plan 1:50 at A1 with ink pen 0.03mm - 0.05mm

As I traced each brick, one by one, I began to think about each imperfection, the labourer laying them, and the slow wear around circulation routes. I developed an appreciation for the hand.

A DIALOGUE BETWEEN BLUNT AND SHARP

Clay Modelling + Computer Script

Process: Chapter 5

Experiments

Formal studies with clay

The aim of this experiment was to test clay forms as individuals and compositions.

Hand modelling was used and it informed the planning process. It was fluid way to visualise and stumble upon new forms.

Clay was successful alongside planning to visualise spaces but later in the design process I looked for a more precise method. As the design developed I introduced a catenary structural system, which required a method of modelling with more structural rigour than clay.

Figure 80. Testing clay forms on site, 16 June 2107

Figure 81. Modelling forms from the same quantity of clay, 15 June 2017

Formal studies with computer

The aim was to use computer to add structural rigour to the form modelling process while retaining elements of the hand.

In August I developed a computer script to do this. The first input is to draw the structural perimeter of the shell structure (*figure 83*). The catenary shell structure is then created from this perimeter. Parameters inside the script are tweaked to adjust heights, opening size and wall thickness (*figure 84*).

I found this a successful way to combine imperfect qualities with structural rigour, however the computer mouse is obviously different to the hand. The computer mouse only translates the 'form' of hand modelling (through the structural perimeter) and not the fluid malleability that comes with it. The beauty of hand modelling is that it is malleable and you can stumble upon ideas.

The introduction of this script was beneficial to sharpening the current form but it limited further formal development. I designed the script for standalone shell structures and because of the rigid interface of the computer was hard to consider alternatives such as the script in *figure 82*. This script still abides by catenary logic but offers wider formal options. I reflect on this in more detail in Chapter 8. The computer script I designed was not perfect at the beginning; it has evolved to reach its current state that was both beneficial and problematic. At the time in August, I was unaware of the influence the script had on the design process.

Figure 82. An alternative catenary script

Figure 83. Drawing the structural perimeter with the computer mouse was a way to introduce hand-like qualities

The script helped the design realise accurate catenary structures but it was limited to standalone forms.

The script introduced hand-like qualities into the form. However, it lost the ability to 'stumble upon' ideas that clay modelling had and ultimately stalled formal development because of it

Figure 84. Grasshopper geometry created with catenary script, 23 Aug. 2017

A parametric script allows the user to easily adjust parameters. It is more flexible than typical computer modelling and grows as more information is added. The first iteration in August modelled only exterior form. It then expanded to include wall thickness and eventually scalloping of the interior form. Although it is in the computer, the script allows a certain malleability and accuracy that would be far too time consuming if done manually with drawing.

The main parameters are highlighted in green:

- Structural grid determines the distance between structural rib members
- Depth of column determines the depth of the structural rib
- Wall thickness
- Roof thickness
- Height of shell structure

DIALOGUE BETWEEN BLUNT AND SHARP

Precedent analysis

Process: Chapter 6

Introduction

Tools used

The aim of this analysis is to explore how existing architecture may have used computer technology. The Rolex Centre (2010) in Switzerland and the Moriyama House (2005) both by SANAA (Kazuyo Sejima and Ryue Nishizawa) are the key precedents analysed.

A vector computer program Adobe Illustrator will be used for the analysis and the various techniques are explained opposite.

Analysing existing precedents in regards to their use of analogue and digital tools

Figure 86. Rolex Centre Plan by SANAA, Switzerland. 2005 - 2010.

Figure 87. Moriyama House by Office of Ryue Nishizawa, Tokyo. 2005.

Deformations of circles are created by default with 4 anchor points (white squares) and 8 handles (blue circles).

The "add anchor points tool" is used to add anchor points between existing anchor points.

Anchor points (blue squares) can be moved and will distort the geometry.

Handles (blue circles) can be moved and will distort the geometry in a different way.

The geometry as a whole can be deformed by pushing and pulling in a XY axis.

Arrow keyboard taps are fixed at 0.5mm increments. When working at 1:1000 this equates to 0.5m.

Figure 88. Techniques to deform and test new geometry using Adobe Illustrator

SANAA Rolex Centre

Large geometries

The aim of this experiment was to look for relationships between the larger void geometries, highlighted in purple. I looked to see if there was a pattern in how these geometries were deformed.

I started with a circle that was the same width as the void. The default *control points* (purple squares) were moved with keyboard arrows at increments of 500mm at 1:1. Once the circle was close to the void in shape *control points* were added (orange squares) and moved with keyboard arrows.

I could have used *handles* to distort the circles however these are only moveable by mouse and would be hard to quantify the exact movements. I did not rotate the geometry. After repeating this process five times I found no obvious correlations between the distortions of circles. I concluded that it would most likely be intuition guiding deformations or tracing a hand drawn geometry.

Figure 89. Analysis of the larger void geometries in the SANAA Rolex Centre plan, analysed at 1:1000

Drawing over precedents revealed far more information than just 'flicking through'

Small geometries

I then traced the smaller geometries (*highlighted in red*) using both *anchor points* and *handles* in Adobe Illustrator. The first one became the base geometry. I then duplicated it, pulled and pushed it in an XY axis until it aligned with the neighbouring geometry. I effectively scaled the base geometry in a non-uniform way.

After repeating the process over every one there appeared to be a strong formal relationship between each geometry. It was unexpected that the geometries would align as well as they did. I then tested the base geometry against a larger void (*highlighted in orange*) but there was no obvious relationship.

Juan Cortes writes that in SANAA's latest work there is "so-called 'topological equivalence' between forms that arise from the deformation (stretching, contracting or twisting) of the original form. These deformations preserve what topologists call the 'intrinsic qualitative properties' of a spatial consideration" (Màrquez Cecilia & Levene, 2008, p.39).

Figure 90. Close-up of analysis showing inconsistencies

The experiment was conducted on a pixelated image of the plan. There is some ambiguity to the accuracy of the results as the tracing (*in red*) does not perfectly align with the scan below. Nevertheless, this experiment has revealed a potential way to link geometries of this nature. Pushing and pulling geometries retains a formal relationship between each one. Considering how technical this approach is, it seems a computer programme of some sort was used at some point. After this analysis it was decided to investigate the *composition* of the Rolex Centre.

Figure 91. Analysis of the smaller geometries in the SANAA Rolex Centre plan, analysed at 1:1000

The computer is used in an interactive way (pushing and pulling) to deform geometry, which has a direct influence on the design outcome

Composition: Offset analysis

In this experiment I analysed the composition of the larger voids. I did this using the 'Offset' tool in Adobe Illustrator. The offset tool creates a duplicate around the geometry at a prescribed distance. I tested different distances at intervals of 0.5m and highlighted the ones that repeated.

There are some reoccurring distances in this composition. 12.5m occurred three times and an exact half 6.25m occurred once. 14m occurred three times. In the larger offsets 22.5m, 47m, and 50m all occurred twice. A few numbers could help compose this arrangement.

Like the analysis on the previous pages the method is not 100% accurate. The offset line does not align exactly with the geometries.

Figure 92. Close-up of analysis showing inaccuracies

Regardless of the accuracy it cannot be concluded that SANAA used this tool when composing these plans or that the consistencies are deliberate. Other factors such as day lighting, programmatic or circulation could determine the reoccurring measurements above. This is still an interesting proposition to compose geometry in this way with a few consistent distances. After this study it was decided to analyse other SANAA geometries with the offset tool to look for relationships.

Figure 93. Composition analysis of the SANAA Rolex Centre plan, analysed at 1:1000

Figure 94. Wider composition analysis of the SANAA Rolex Centre plan, analysed at 1:1000

Some offset lines for 50m and 47m have been omitted for clarity.

Moriyama House

Composition: Offset analysis

The aim of this experiment was to look for patterns in the spatial arrangements in the Moriyama House plan. I analysed the composition using the 'Offset' tool in Adobe Illustrator. I tested different distances at intervals of 50mm and highlighted the measurements that repeated.

I found that 250mm and 1250mm were reoccurring distances that linked geometries together (*figure 96*). 1250mm is also the width of the two bathrooms. One of the rooms measures 2734mm and is used elsewhere to determine widths, lengths and spaces in between (*highlighted in green*).

This experiment demonstrated a potential way to link geometry through the reoccurring use of measurements. Each geometry could be linked to each other by at least one reoccurring distance.

The Moriyama House plan is more accurate than the Rolex Centre however it cannot be concluded that the architect used this tool when composing the plan. Japanese architects may use different units of measurement such as tatami mat sizes to order their geometry.

Figure 95. Moriyama House by Office of Ryue Nishizawa, Tokyo. 2005.

The computer is seen as a potential way to compose geometries, something typically done by intuition

Figure 96. Offset analysis of the Moriyama House. 1:200 at A4

Summary

Re-interpreting findings

The analysis of SANAA's plans influenced the next series of design development. Before the analysis I was using a *non-hierarchical* organisation (figure 97). The composition analysis on the separated geometries in the Moriyama House and Rolex Centre revealed a similar *non-hierarchical* organisation. At this point in September I designed in section and learnt that separated spaces like this can be problematic. I explain this in more detail in Chapter 7. As a point of departure from SANAA I introduced a *hierarchical* organisation linking geometries together.

In the first iteration I traced the hand-drawn geometries in plan (figure 98). Guidelines around the main hall were created at 3m intervals using the offset tool. The other geometries were then aligned to the guidelines.

In the second iteration I traced the main hall and used it as the master geometry (figure 99). The master was duplicated, pushed and pulled to the size of the other geometries. Deforming just one geometry preserves the 'topological equivalence' between them. It was then rotated to align perpendicular with the guidelines which seemed to relate better to the main hall.

Reflection

Without confirmation from the architect themselves this research is inconclusive. It has however revealed ways the computer could distort and arrange geometry, something typically done by hand.

When asked about irregular geometries such as those in the Rolex Centre Nishizawa states "those results are influenced by our use of the computer... and computers define what could be free hand drawing" (Màrquez Cecilia & Levene, 2008, p.14)

In SANAA's case the computer has been deliberately used to influence the design development. These findings were tested and expanded on in my own design development.

Figure 97. First introduction of composition logic, 10 Aug. 2017

Figure 98. Using offset logic to guide the composition of geometries. 20 Sep. 2018

Drawing a section revealed separated spaces are problematic and with the computer, the composition shifted from a non-hierarchical logic to a hierarchical logic, linking spaces together

The design uses the accuracy of the computer to refine and arrange irregular shaped geometry in plan

Figure 99. Using transformations of one geometry and rotating them to respond to offset logic. 05 October 2018

RELATED WORK

The design in relation to other work

Discussion: Chapter 7

Figure 100. The Mapungubwe Centre looks to resemble a system of caves, something culturally significant to the local people. Peter Rich, South Africa. 2005 - 2009

Positioning

Peter Rich: different interpretations of place

Peter Rich's Mapungubwe Centre in South Africa was a precedent for its similarity in construction techniques. Later in the design process it was observed that while the Mapungubwe Centre and the Paraparaumu Clubhouse have similar construction, the ideas behind it differ.

Peter Rich often talks about architecture that connects to place. The Mapungubwe Centre in is a World Heritage Site and looks to "resemble a system of caves, which is culturally significant" (Fagan, 2010, p. 45). To the indigenous caves were regarded "not only as places of refuge and shelter but also ritually, in rain making ceremonies"(Fagan, 2010, p. 45).

The ancient history inspired the use of brick vaults whereas the modern history inspired the Paraparaumu Clubhouse. It is more about communicating with an existing culture through a modular tectonic, rather than communicating with an ancient culture.

Figure 101. The Mapungubwe Centre sits in the Mapungubwe National Park

Figure 102. Existing changing rooms

Figure 103. Paraparaumu Clubhouse communicates to existing culture through modular tectonic

Eladio Dieste: variations on structural symmetry

The interest in modular construction techniques stems from the typical cement block found in the Paraparaumu Domain changing rooms. The modular block was seen as a way to connect to local culture and when testing these *'The Incident'* occurred, revealing an opportunity for more complex and technical possibilities. This construction did evolve however as it was tested against local site conditions in New Zealand.

Eladio Dieste was a Uruguayan engineer known for his innovative use of masonry. He often used structural brick in arches and freestanding vaults. Typically timber formwork is used to position bricks, with reinforcing steel laid and concrete spread over top to complete the structure. Dieste often designed pragmatic industry and agricultural shelters but these still have an elegance to them.

* * *

The existing Paraparaumu Clubrooms are unpretentious and modest, beauty is seen as excess and not of concern. There is no ornamentation. Dieste's work held appeal as a concept as the brick vaults are strictly structural, there is no ornamentation. I saw this as an avenue to introduce more technical and spatial possibilities into the design while retaining some of the essence of the existing culture in the Domain. At this point I adopted Dieste's construction techniques and continued designing.

Conflicts arose in the design process as this construction technique was put across the in school engineer. Uruguay has a significantly low earthquake risk and Dieste's structures don't typically consider lateral loads with the same rigor as structures in New Zealand. The grain silo does include double curvature to resist the heavy loading of any stored material but is not designed for strong wind or earthquakes. Preliminary structural ribs and eventually scallops were introduced, but this meant the structural system changed from a pure shell structure to a moment frame structure.

* * *

The moment frame structure meant structural symmetry, common in Dieste's work, was not necessary. The gravity resisting structure still abides to catenary shell logic but the lateral resisting structure became moment frames. This opened opportunities for the form to have irregular perimeters that the computer script could accurately calculate.

As a point of departure from Dieste a new formal language emerged. The application of catenary logic through a computer script allowed me to test irregular shaped geometries with some accuracy. It demonstrated new opportunities for earthquake strengthened structures. Problems however, emerged after the computer script was developed. The script was designed for standalone catenary structures like Dieste's, but as the structural system shifted from shells to moment frames other formal opportunities were possible but overlooked. I reflect more on why this occurred in a discussion in Chapter 8.

On reflection a conceptual weakness also emerged as the design became more complex. With irregular geometries the cost of the building had increased significantly and some of the pragmatic origins and essence of the original site were lost. This was acknowledged, but given the scope of the research I continued designing to focus on the relationship between analogue and digital tools.

Figure 104. Small wood strips, nailed to the timber formwork, position the bricks

Figure 105. Prestressed steel covered in concrete

Figure 106. Paraparaumu Clubhouse uses scalloping to embed moment frames into the walls which allow the form to inherit irregular geometries.

Figure 107. The interior space of the Silo is an impressive double curvature vault that spans 30m by Eladio Dieste, Uruguay. 1976-78

Figure 108. The curvature in the Silo resists heavy loading from stored materials.

The influence of SANAA

Rolex Centre (2010) + Moriyama House (2005)

In July I began to explore the dialogue between blunt and sharp; the relationship between analogue and digital tools. I was however '*flicking through*' SANAA's plans of the Moriyama House and the Rolex Centre on the side. The spatial arrangement of the Moriyama House was intriguing and the irregular geometries of the Rolex Centre seemed relevant to the dialogue between blunt and sharp. I was not aware of the problems this casual '*flicking through*' caused until later in the design process.

The main problem was that I had not researched enough into these buildings and architects before using them as a precedent. My first experiments were largely imitative, taking the graphic and applying it to my work. I introduced irregular hand-drawn geometries, like the Rolex Centre, by approximating the programme (*figure 111 & 113*). These spaces were then arranged in a similar manner to the Moriyama House (*figure 112 & 114*). This developed an affection for composition and resulted in a lot of time spent in plan. I wasn't critical of them as a precedent until September when I properly designed in section and read into SANAA's ideas behind these buildings.

The first conflict I observed was in my obsession for geometric composition. I unconsciously adopted a similar method to Kazuyo Sejima where she works strictly in plan refining the diagram, and "once she has a final diagram, her schemes are immediately converted into reality" (Màrquez Cecilia & Levene, 2008, p. 57). Sejima's obsession with composition is deliberate, for this composition is expressed in the final architecture through an "elaborate process of fine detailing and a constrained material palette". This retains "the immateriality of the 2-D graphic schemes in three dimensional reality" (Màrquez Cecilia & Levene, 2008, p. 57).

If I had looked at SANAA's sections closer I would have realised most are pure vertical extrusions of the floor plan. This is demonstrated in the Rolex Centre as it looks like a thick piece of paper with holes in it (*figure 109*). The interior detailing allows the user to see and retain some of the relationships between voids and spaces, expressing what is evident in plan (*figure 110*).

The difference to my design is that I was never trying to express the diagram in architecture. My sections and materials were very different. Shell structures and brick are completely different spatial experiences to the Rolex Centre. SANAA are interested in a refined translation of the *diagram* to architecture, whereas I am interested in a translation of *drawing* into architecture. I am more interested in the qualities of hand drawing rather than just the form. In the Rolex Centre irregular 'hand-drawn' geometries are translated into architecture through thin, austere materials. In the Paraparaumu Clubhouse irregular 'hand-drawn' geometries are translated into architecture through bricks, each with its own imperfection. I realised my design had a different purpose than the Rolex Centre and it begged the question, why was I spending so long designing in plan working on this composition? This question prompted the idea of switching modes to section, which notably shifted design development.

* * *

Figure 109. Rolex Centre from above appears as a giant piece of paper.

Figure 110. Rolex Centre interior retains some of the relationships evident in plan, in this case the irregular shaped voids.

Figure 111. Approximating programme. 07 July 2017

Figure 113. Rolex Centre Plan by SANAA, Switzerland. 2005 - 2010.

Figure 112. Arranging 'cut-up' spaces. 07 July 2017

Figure 114. Moriama House by Office of Ryue Nishizawa, Tokyo. 2005.

The second conflict I observed was with the separated spaces in the design. In the Moriyama House separating spaces works as it is a residential building. The spaces in-between are cosy and the distance to travel is small (*figure 114*). The Paraparaumu Clubhouse however, is a public building and required multiple spaces to be shared between stakeholders. The spaces between are larger and going outside to move in between becomes difficult, especially in winter.

On reflection there were options for the clubhouse to have separated spaces with small distances in between as shown in *figure 120* and *figure 121*, but these were not considered. Admittedly I was looking for the 'separated graphic' and not thinking about how these spaces actually worked. This is exemplified by the fact I didn't acknowledge the residential scale of the Moriyama House. Even SANAA do not have separated spaces in public buildings. The Towada Art Centre has separated forms but they are linked with enclosed walkways in between (*figure 116*).

This conflict continued after I drew a section which revealed weak in-between spaces. According to the book 'Public Places - Urban Spaces' the ratio between street width to wall height determines the sense of enclosure. It recommends a ratio of 1:2 to 0.5:1 for good to strong sense of enclosure. The Moriyama House has a ratio under 1:1 which forms an intimate sense of enclosure (*figure 117*). My design has a weaker sense of enclosure obviously because the spaces are spread further apart, but also because of the form (*figure 118*). The shell structure means the vertical plane falls away from the inhabitant often resulting in ratio of 1:2 to 1:3. Separating spaces was not as desirable now I considered it in section. It was after acknowledging these conflicts that I began to position the design.

* * *

As a point of departure from SANAA the final design of the Paraparaumu Clubhouse differs in translations from diagram/drawing to architecture. It also shifts from a *non-hierarchical* composition to a *hierarchical* composition as mentioned on page 94. This happened simultaneously with the section development that linked separated spaces together.

It seems therefore a few things can be learnt from this research. Firstly it appears that spatial conditions are not always scalable as I found out with the separated spaces in the Moriyama House. It also can be problematic to casually '*flick through*' precedents and introduce them into design without considering them in their entirety. A known alternative to '*flicking through*' is analysis by drawing. After I traced the Moriyama House and Rolex Centre in Chapter 6 I discovered much more than when I just looked at them.

SANAA was a relevant precedent for the irregular geometries in the Rolex Centre created by hand and computer, however their strict design process was not. This is interesting because so often in architecture school we look at precedents and create variations of them. We tend to look on the surface and not investigate. I was intrigued by a plan and created a variation without looking at the full picture; the architect, their thinking, the context, the sections and elevations. This was problematic and it was only after two months of designing that I actually noticed and responded with critique and shift in design thinking. The design would have benefitted if I was more aware of SANAA's influence and this shift happened earlier.

Figure 115. A section from the digital model revealed conflicts in the design, namely the separation of spaces. 05 Sep. 2017

Figure 116. Towada Art Centre by Office of Ryue Nishizawa, Aomori, Japan. 2005

Figure 117. Moriama House spatial analysis

Figure 118. Own design spatial analysis

Figure 119. The majority of the spaces are separated in this preliminary plan, 10 Aug. 2017

Figure 120. Alternative option 1 that was not considered

Figure 121. Alternative option 2 that was not considered

RELATED WORK

The dialogue in relation to other work

Discussion: Chapter 8

Discussion on the dialogue between 'Blunt and Sharp'

Digital and Analogue tools

In my experience hand drawing has been successful at uncovering design ideas. During my process of book-ending the use of butter paper was messy and I often made mistakes, drawing lines and redrawing them. I observed that there was a feedback loop of learning where I would draw something then modify it by drawing over top. Glenn Murcutt, an avid critic of the computer, observes that "when you draw you arrive at the solution before you know you've arrived at it. In the computer... you have set up most of the things before you get there" (Ozetecture, 2014, 20:10).

The script I developed was effective at creating catenary shell structures but slowed formal design development. While I improved my skill in grasshopper there was no translation back into the design development. This is illustrated by the fact the formal development stalled once the script was established. I committed to a standalone shell structure and made a script for exactly that. While creating this particular script I couldn't engage with the design and consider alternatives such as the script in *figure 122*. The medium I was working in was rigid and didn't allow a feedback loop of learning that I experienced with hand-drawing.

* * *

Richard Sennett in his book *The Craftsman* talks about developing skill through repetition and practice. He argues that through repetition "the open relation between problem solving and problem finding... builds and expands skills" (Sennett, 2008, p. 38). A tennis player will repeat a tennis serve again and again, and with each error correct themselves, adjust and learn to aim the ball in different ways. In my design process I observed this through adjustments with pen and pencil on layers of butter paper. With time I developed skill in understanding current planning problems. Sennett also mentions how CAD (computer-aided design) can abort learning and skill development, as in CAD the algorithms do the drawing not the designer.

CAD doesn't stimulate the designer like the tactile and incomplete nature of hand drawing. "When you draw a site, when you put in the contour lines and the trees, it becomes ingrained in your mind. You get to know a terrain by tracing and retracing it, not by letting the computer regenerate it for you" (Sennett, 2008, p. 40). In this way the computer can hinder skill development and learning in the design process.

I agree with Sennett in this regard and observed the computer script stagnated learning in the design process, however I believe the relationship between learning and computer can be expanded. Firstly a designer is not immediately an expert at a computer programme. When I created the script I was unskilled and only through consistent repetition did I develop sufficient skill. It was in this period of learning Grasshopper that 'The Incident' occurred. Not only did 'The Incident' help me to refine my Grasshopper skills but also developed my design skills, expanding possibilities for concrete block arrangements and spatial qualities inside the changing room. If I was skilled in Grasshopper this discovery would have never happened. As crude as it was, the outcome aided design learning and design development. It was only when I became skilled at Grasshopper with the final script did problems occur. In my observation it seems the problem is not the use of the computer but how it is used.

* * *

Figure 123. Early iterations in Grasshopper trying to get the script to stack bricks in a buildable manner

Figure 122. An alternative computer script that is bound by catenary logic

So when could one use the computer? The first step is to acknowledge analogue and digital processes are fundamentally different tools. When I introduced the computer (Adobe Illustrator) into the 'bookending' process I was conscious of using it as a tool to refine geometry but only with the intention of going back to hand drawing and critiquing it. I understood the idea of things being too rigid and difficult to work, hence the idea of sharpening then critiquing. In reflection it would have been wise to use this same method with the computer script.

Renzo Piano is quoted on his design process:
"You start by sketching, then you do a drawing, then you make a model, and then you go to reality - you go to the site - and then you go back to the drawing. You build up a kind of circularity between drawing and making and back again" (Sennett, 2008, p. 40).

In my process I adopted a circularity through such techniques as book-ending but this was predominantly in plan. I also observed that I had two conveyor belts of development: one was the development of plan and section (hand and computer), and the other was form (computer) (*figure 124*). It would have been beneficial to expand on Piano's process and switch between a stack of plans, then sections, then to the computer script, back to plans and so on. Here weaving hand-drawn critique wherever possible (*figure 125*). This would have broken the rigidity I felt while using the computer script and enabled a stronger critique of the forms produced by the script.

But is it just the timing of when we use analogue and digital tools in the design process that determines their effectiveness? Juhani Pallasmaa argues that it is the haptic connection of hand-drawing over the computer that makes it a more successful design tool.

* * *

Figure 124. Observed design process over the year

Figure 125. Refined design process

Juhani Pallasmaa argues that hand-drawing is more beneficial than the computer when it comes to connecting the designer with what they are designing. Pallasmaa states that when we design, the object is simultaneously “held in the palm of the hand and inside the brain. Ultimately the object becomes an extension and part of the designer’s body” (Pallasmaa, 2009, p. 97). It is through the haptic connection the process of repetition, crystallising and refining drawings by hand that the designer gets deeply involved and matures in thinking. It is not the same with the computer which has a physical disconnection through the mouse and the ability of instant erasure. (Sennett, 2008)

At the end of the year I developed a new appreciation for hand-drawing in the design process. In preparation for the final review I embarked on a large hand drawn plan at 1:50 (*figure 126*) to convey the qualities of bricks not possible at smaller scales like 1:200. As I drew each brick I began to think about its materiality. I began to think about their imperfect edges, the scuffing around circulation routes, how a labourer might lay them and the time involved in this procedure. If I had added a brick texture in the computer it may have taken under a minute but the learning and consideration would be non-existent.

Reflecting on the script design, if I had to calculate and draw each catenary curve, alternative forms may have evolved. Hand drawing in section could have prompted other ideas like linking shell structures to arrive sooner than they did. From my observations I agree that hand drawing fosters a stronger connection between designer and design, but Pallasmaa furthers this by adding that hand drawn design processes also affects the inhabitable experience.

* * *

Figure 126. Hand-drawn plan 1:50 at A2 with ink pen 0.03mm - 0.05mm

In the text 'The Thinking Hand' Pallasmaa argues that buildings designed by hand have a stronger connection with the inhabitant than those designed by the computer. He uses Alvar Aalto's Church of Three Crosses (*figure 128*) to demonstrate how a building designed completely by hand "is powerfully real, and due to its strong sense of materiality and construction it addresses and awakens our bodies and imagination so gracefully. The architectural structure exists fully and comfortably in the same reality of life that our bodies occupy, not in a weightless and scaleless mathematical space" (Pallasmaa, 2009 p. 99).

What Pallasmaa argues is valid today as there are many buildings designed completely in the computer and as a result can lack a human scale and consideration for the user. The exterior and interior of the CCTV headquarters by OMA in Beijing are good examples of this (*figure 127*). However, does the fact the computer was used really mean there is a weaker connection between the space and the occupant? One could argue that the straight lines and complex corner joints in Aalto's Church don't exist comfortably in our bodies' reality as Pallasmaa describes. The form of Toyo Ito's Opera House (*figure 130*) was conceived by explorations of the grid in the computer, the result being a cave-like experience. It was designed in a 'weightless and mathematical scaleless space' but I would argue it indeed 'awakens the body and imagination'. The interior spaces do feel scaleless but so too is a cave, the earliest form of human occupation.

In my own design the form was designed solely by the computer script but the interior details developed by hand. In my opinion there is a finer sense of scale which is a result of hand-drawn development (*figure 129*). While I do agree with Pallasmaa that a hand-drawn process has an effect on the final space, I disagree that all strictly computer designed architecture lacks connection to the occupant. I argue it is the final architecture that determines the occupant's connection to a space rather than strictly the process that developed it.

Figure 127. Interior and exterior of CCTV building by OMA, 2004 - 2012

Figure 128. Interior of The Church of Three Crosses by Alvar Aalto, 1955

Figure 129. Interior of the Paraparaumu Clubhouse

Figure 130. Interior of the Taichung Opera House in Taiwan by Toyo Ito, 2009 - 2014

Figure 131. Early stages of Toyo Ito's design process uses the computer to explore opportunities in the grid

CONCLUSION

Chapter 9

Summary of findings

In summary different architectural tools have different effects on the design development. In general, blunt instruments such as pencil and clay have certain fluidity and malleability to them. They are messy and imperfect, allowing you to test, make mistakes and stumble upon ideas. In contrast, sharp tools such as ink pen and the computer help refine ideas and make your intentions clear. In most cases an effective way to design is to switch between blunt and sharp tools, as processes like *'Bookending'* demonstrate.

Hand drawing typically provides better feedback loops of learning than the computer. Pallasmaa attributes this to a haptic connection between user and the design, something disrupted by the computer mouse. These processes can affect design development. The grasshopper script demonstrated how computer interfaces can be difficult to engage with and ultimately can hinder potential design development. Computer processes can also affect the experience of the final architecture.

The line between blunt and sharp does blur when analogue and digital tools cross over. *'The Incident'* revealed that computers are not always perfect and in its errors opportunities for design learning arise. Analysis of SANAA's projects speculates on composing and distorting with the computer, something typically done by the hand. How we interpret precedents in the design process is also important. Drawing over SANAA's work revealed far information more than just *'flicking through'*; a typical practice in architecture school.

Where to from here?

This research interrogates the relationship between analogue and digital tools and considers how these influence design development. It has looked in detail into some of the tools architects use; pens, pencils, butter paper, cartridge paper, with computer programs Adobe Illustrator and Grasshopper.

The research could expand in more detail on areas where analogue and digital tools cross over. It would be interesting to use computer tablets with tablet pens and VR (virtual reality) headsets in a design process and reflect on how these influence the design development. These tools are far more interactive than a computer mouse but still have the burden of 'instant erasure'; something Richard Sennett warns us of in his book 'The Craftsman'.

The way precedents are analysed has an effect on the design development. The influence that precedents, especially those with a seductive graphic, have on students is problematic and commonplace in architecture school. It would be valuable to explore this relationship in more detail, considering other modes of analysis through analogue and digital tools.

Bibliography

- Adamson, G. (2007). *Thinking through craft*. Oxford, New York: Berg.
- Anderson, S., Dieste, E., & ProQuest. (2004). *Eladio Dieste : innovation in structural art*. New York: Princeton Architectural Press.
- Carmona, M. (2012). *Public Places - Urban Spaces*: United Kingdom: Routledge Ltd.
- Chard, N. (2014). Church of the Three Crosses, Vuoksenniska – Sliding Walls. Retrieved from <https://natchard.com/2014/01/27/church-of-the-three-crosses-vuoksenniska-sliding-walls/>
- Council., K. N. Z. B. (1988). *The Celebration history of the Kapiti district : 100 years plus / compiled by Olive Baldwin*. Paraparaumu, N.Z.: Kapiti Borough Council.
- Downton, P. (2003). *Design research*. Melbourne: Melbourne : RMIT Publishing.
- Fagan, G. (2010). PETER RICH ARCHITECTS MAPUNGUBWE INTERPRETATION CENTRE MAPUNGUBWE NATIONAL PARK, SOUTH AFRICA. *Architectural Review*, 227 (1356), 40-47.
- Itô, T., Márquez Cecilia, F., & Levene, R. C. (2009). *Toyo Ito, 2005-2009 : espacio líquido = liquid space*. Madrid: El Croquis Editorial.
- Kim, H. J. (2010). Catenary – Maya nCloth. Retrieved from <http://crtl-i.com/blog/category/mel/>
- Koren, L. (1994). *Wabi-sabi for artists, designers, poets & philosophers*. Berkeley, California: Stone Bridge Press.
- Levene, R. C., Nishizawa, R. e., & Sejima, K. (2011). *Sanaa : 2008-2011 arquitectura inorganica = inorganic architecture*. Madrid: El Croquis.
- Màrquez Cecilia, F., & Levene, R. C. (2008). *Sanaa : Kazuyo Sejima, Ryue Nishizawa, 2004-2008 : topologia arquitectonica = architectural topology*. Madrid : El Croquis Editorial.
- Ozetecture (Writer). (2014). Glenn Murcutt and Richard Leplastrier in conversation. In U. o. Newcastle (Producer). Architecture Foundation Australia.

Pallasmaa, J. (2009). *The thinking hand : existential and embodied wisdom in architecture*. Chichester, U.K. : Wiley.

Sejima, K. (2000). *Kazuyo Sejima, Ryue Nishizawa, 1995-2000 : making the boundary = trazando los limites / [publishers and editors Richard C. Levene, Fernando Marquez Cecilia]*. Barcelona: El Croquis.

Steele, J. (1998). *Rethinking modernism for the developing world : the complete architecture of Balkrishna Doshi*. New York: Whitney Library of Design.

List of figures

Note: unattributed figures belong to the author

- Figure 9. Council., K. N. Z. B. (1988). *Paraparaumu Rugby Football Team ,1927* [Book] p. 243. from *The Celebration history of the Kapiti district : 100 years plus / compiled by Olive Baldwin*. Paraparaumu, N.Z.: Kapiti Borough Council. 5
- Figure 10. Council., K. N. Z. B. (1988). *Kapiti Pony Club ,1981* [Book] p. 245. from *The Celebration history of the Kapiti district : 100 years plus / compiled by Olive Baldwin*. Paraparaumu, N.Z.: Kapiti Borough Council. 5
- Figure 11. Council., K. N. Z. B. (1988). *Paraparaumu Bowling Club*. [Book] p. 245. from *The Celebration history of the Kapiti district : 100 years plus / compiled by Olive Baldwin*. Paraparaumu, N.Z.: Kapiti Borough Council. 5
- Figure 12. Council., K. N. Z. B. (1988). *Preparing to go sailing, Kapiti Boating Club*. [Book] p. 245. from *The Celebration history of the Kapiti district : 100 years plus / compiled by Olive Baldwin*. Paraparaumu, N.Z.: Kapiti Borough Council. 5
- Figure 13. Aerial image showing Paraparaumu Township. Google Maps. (2018). *Paraparaumu Township*. Retrieved from <https://goo.gl/maps/RUUAjC5DpRA2>. 7
- Figure 27. Fagan, G. (2010). *Construction at the Mapungubwe Centre, Peter Rich Architects* [Journal]. from *Architectural Review*, 227 (1356), 40-47. 21
- Figure 86. Màrquez Cecilia, F., & Levene, R. C. (2008). *Rolex Centre Plan by SANAA, Switzerland*. [Book] p. 182. from *Sanaa : Kazuyo Sejima, Ryue Nishizawa, 2004-2008 : topologia arquitectonica = architectural topology*. Madrid : El Croquis Editorial. 78
- Figure 87. Màrquez Cecilia, F., & Levene, R. C. (2008). *Moriyama House by Office of Ryue Nishizawa, Tokyo*. [Book] p. 288. from *Sanaa : Kazuyo Sejima, Ryue Nishizawa, 2004-2008 : topologia arquitectonica = architectural topology*. Madrid : El Croquis Editorial. 78
- Figure 95. Màrquez Cecilia, F., & Levene, R. C. (2008). *Moriyama House by Office of Ryue Nishizawa, Tokyo*. [Book] p. 288. from *Sanaa : Kazuyo Sejima, Ryue Nishizawa, 2004-2008 : topologia arquitectonica = architectural topology*. Madrid : El Croquis Editorial. 86
- Figure 100. Fagan, G. (2010). *The Mapungubwe Centre looks to resemble a system of caves, something culturally significant to the local people. Peter Rich, South Africa. 2005 - 2009*. [Journal] from *Architectural Review*, 227 (1356), p. 42. 92

- Figure 101. Fagan, G. (2010). *The Mapungubwe Centre sits in the Mapungubwe National Park*. [Journal] from *Architectural Review*, 227 (1356), p. 40. 93
- Figure 104. Anderson, S., Dieste, E., & ProQuest. (2004). *Small wood strips, nailed to the timber formwork, position the bricks*. [Book] p. 199. from *Eladio Dieste : innovation in structural art*. New York: Princeton Architectural Press. 95
- Figure 105. Anderson, S., Dieste, E., & ProQuest. (2004). *Prestressed steel covered in concrete* [Book] p. 199. from *Eladio Dieste : innovation in structural art*. New York: Princeton Architectural Press. 95
- Figure 107. Anderson, S., Dieste, E., & ProQuest. (2004). *The interior space of the Silo is an impressive double curvature vault that spans 30m by Eladio Dieste, Uruguay. 1976-78*. [Book] p. 100. from *Eladio Dieste : innovation in structural art*. New York: Princeton Architectural Press. 95
- Figure 108. Anderson, S., Dieste, E., & ProQuest. (2004). *The curvature in the Silo resists heavy loading from stored materials. 1976-78*. [Book] p. 110. from *Eladio Dieste : innovation in structural art*. New York: Princeton Architectural Press. 95
- Figure 109. Levene, R. C., Nishizawa, R. e., & Sejima, K. (2011). *Rolex Centre from above appears as a giant piece of paper*. [Book] p. 31. from *Sanaa : 2008-2011 arquitectura inorganica = inorganic architecture*. Madrid: El Croquis. 97
- Figure 110. Levene, R. C., Nishizawa, R. e., & Sejima, K. (2011). *Rolex Centre interior retains some of the relationships evident in plan, in this case the irregular shaped voids*. [Book] p. 54. Madrid: El Croquis. 97
- Figure 113. Màrquez Cecilia, F., & Levene, R. C. (2008). *Rolex Centre Plan by SANAA, Switzerland*. [Book] p. 182. from *Sanaa : Kazuyo Sejima, Ryue Nishizawa, 2004-2008 : topologia arquitectonica = architectural topology*. Madrid : El Croquis Editorial. 97
- Figure 114. Màrquez Cecilia, F., & Levene, R. C. (2008). *Moriyama House by Office of Ryue Nishizawa, Tokyo*. [Book] p. 288. from *Sanaa : Kazuyo Sejima, Ryue Nishizawa, 2004-2008 : topologia arquitectonica = architectural topology*. Madrid : El Croquis Editorial. 97
- Figure 116. Màrquez Cecilia, F., & Levene, R. C. (2008). *Towada Art Centre by Office of Ryue Nishizawa, Aomori, Japan. 2005*. [Book] p. 37. from *Sanaa : Kazuyo Sejima, Ryue Nishizawa, 2004-2008 : topologia arquitectonica = architectural topology*. Madrid : El Croquis Editorial. 99

- Figure 122. Kim, H. J. (2010). *An alternative computer script that is bound by catenary logic* [Blog]. Retrieved from <http://crtl-i.com/blog/category/mel/> 103
- Figure 127. 1st-Architecture. (2013). *Interior and exterior of CCTV building by OMA, 2004 - 2012*. [Blog] Retrieved from <http://1st-architecture.blogspot.co.nz/2013/02/cctv-headquarters-beijing-oma.html> 108
- Figure 128. Chard, N. (2014). *Interior of The Church of Three Crosses by Alvar Aalto, 1955*. [Blog]. Retrieved from <https://natchard.com/2014/01/27/church-of-the-three-crosses-vuoksenniska-sliding-walls/> 108
- Figure 130. studiomillspace. (2016). *Interior of the Taichung Opera House in Taiwan by Toyo Ito, 2009 - 2014*. [Blog]. Retrieved from <http://www.studiomillspace.com/architecture-photography/toyo-ito-taichung-metropolitan-opera-house> 109
- Figure 131. Itō, T., Márquez Cecilia, F., & Levene, R. C. (2009). *Early stages of Toyo Ito's design process uses the computer to explore opportunities in the grid*. [Book] p. 167. from *Toyo Ito, 2005-2009 : espacio líquido = liquid space*. Madrid: El Croquis Editorial. 109

DRAWING IN THE DOMAIN

The end, for now

This is for you Jeremy Palmer, the one who never stopped learning.

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