A Pattern Language

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Research Project

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ABSTRACT

"How can the methods and processes of fashion and clothing design influence the design processes and solutions of architectural problems"

Architecture and fashion have a long-standing relationship. There are obvious ties between the sheltering and protection of entities, but there are other complex relationships such as the translation of form from 2D flat materials into built 3D forms, that offer a great richness to architecture - especially in today’s age of computer aided design, drawing, and construction practices.

Pattern making is a simple methodology (adopted from clothing design and construction), which allows one to design, manipulate, and adapt certain ideas by an iterative process. A pattern is easily constructed, modified and re-modified time and time again, providing a designer with a ‘collection’ of pieces from a specific range.

As an architect uses a site (plan or model) to investigate the options and design possibilities latent in a place, the clothing designer has their mannequin. This project adopts this use of a ‘mannequin’ as a formal type of scaffolding, around which surfaces are distorted and manipulated through an iterative process, to see the possible solutions that this discipline can offer an architectural problem.

In this scenario, the site is a place of industrial ruins - a deteriorating 1900’s meat works factory at the head of the Whangarei Harbour. The ruins provide rich skeletal formwork, in which an architectural intervention is readily accepted. 'The Paper Mill' is an industrial building, that re-animates the ex-industrial site in a contemporary manner, and the box-like factory forms provide a mannequin for skin manipulation studies, forming the basis of this architectural investigation.
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There is a long connection between architecture and clothing, and although they address different scales, they both directly affect the human condition. They provide cover for the human body - giving a sense of protection and security - but furthermore, are sculptural and aesthetic objects in themselves. Architecture creates spaces, which are not only sculptural, but regulates the way in which we interact with society – it has a direct effect on our emotions and social behavior. Similarly, as clothing designer Tomoko Nakamichi explains, “…garments we design ourselves appeal to the emotions as well as the eye…”¹, proving there is a mutual appreciation of sculpture, aesthetics and emotions.

Parallel methods in the construction of garments and fabrication of architectural surfaces, is nothing new. However, with the aid of computer technology, the ability to create intricate and complex forms, have never before been so manageable. What interests me is the potential that lies in the crossing over of these two disciplines, and in particular, what architecture can learn from the fashion industry.

Pleating, folding, wrapping, weaving and gathering, are some of the techniques that have the potential to be adopted from pattern making/clothing design, and exploited in the construction of architectural surfaces. With these techniques, along with other similar methods of garment design and construction in the fashion industry, I aim to experiment with paper and fabric to produce formal models for architectural application. Exploration and experimentation of ways in which flat 2D materials can become compound and dynamic surfaces, will provide me with a palette of useful form-finding techniques. The experiment will investigate how the use of pattern making/fashion, or clothing manufacturing techniques, can inform and help generate innovative architectural forms and space.

In my opinion, this concept has yet to be fully explored in New Zealand architecture. For a Pacific country with such a strong history of garment making, (for example, Maori are terrific weavers), and a progressively innovative and thriving fashion industry, it seems a little ironic that we have yet to exploit these techniques and take them into the 21st century. Therefore, my research question is, how can methods and processes of clothing design, be utilised and interrogated to enhance architecture?

Weaving, knitting, crocheting, and organic growth are just some of the ways in which fiber composites can be manipulated to produce a fabric. These diverse composites produce processed fabrics with differing thermal qualities, textures, thicknesses, opacities, and tensions. For a clothing designer, the art of creating lies within the ideology of manipulating fabrics with particular qualities, to affect the human body in an intentional and particular way. Whether it is to enhance a particular feature of the body for aesthetic purposes, or to offer more shelter and warmth, fabric provides clothing designers the most vital tool for creation.

Similarly, “...textiles are some of the oldest materials used in architecture. According to Gottfried Semper (1803-1879), the most influential architect and theorist of his time, architecture itself began with textiles...”

“Textiles, on a vast scale, soften a space and offer a sense of movement and tactility.” For this reason, many contemporary textile designers have been commissioned to provide these certain elements to architectural spaces. Dutch designer, Jongstra has applied the fabric to the interior surface in such a way, which provides the architect with ‘the opportunity to bring something theatrical to (the) space as well as creating an interior texture.’

[Fabric, as a construction material, isn’t typically used as exterior cladding. There are issues of rigidity, which pose structural implications. Where it starts to become interesting in its application to architecture is its ability to achieve fluidity that conventional construction materials are unable to do. ‘Textiles, on a vast scale, soften a space and offer a sense of movement and tactility.’ This idea of portraying movement directly relates to the design process of fashion designers – they explore construction techniques of garments using fabrics, to ultimately cater to the way in which the human body moves, and what implications’ allowing this movement has on its end user. By using a material that can be manipulated in the same way that fashion designers are already doing, and then applying it to architecture, it suggests that fabric has the potential to be manipulated in a theatrical way – not only in terms of aesthetics, but in the way a fabric building skin might affect its internal environment. Jongstra has applied the fabric to the interior surface in a similar way, ‘which provides the architect with ‘the opportunity to bring something theatrical to (the) space as well as creating an interior texture.’]

Another textile designer who works with felt in architecture is Anne Kyyro Quinn. In the book ‘Textile Designers at the Cutting Edge’ by Bradley Quinn Kyyro Quinn states: ‘working in an

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4 ibid
5 ibid
architectural way enables me to take natural fabrics in new directions, it’s so exciting when you
discover how much more they can do.’ For her felt created warmer and intimate environments
while absorbing sound as well. She has taken a traditional material and transformed it into a
product of the now.”

‘Another Dutch designer, Petra Blaisse, works with architects and urban planners to create site-
specific pieces. Bradley Quinn [Textile Designers at the Cutting Edge] describes the work of
Blaisse’s studio, Inside Outside, “their implementations have been described as warm, elegant,
sensual and female – a direct contrast to descriptions such as static, male, or even cold, that
often characterize contemporary architecture. Her works are not intended to make architecture
more feminine but to introduce soft forms that harmonize with the architect’s ambition to make
buildings more fluid, labile and interactive.”

While Blaisse states: “Textiles can connect many forms of human experience therefore they
have emotional and cultural significance for almost everyone today. Time, fashions and
environments create experiences, while textiles represent a global language of memory and
emotions. These sensations are amplified by our textiles - because they are often large scale,
yet augment their effects. The textiles make almost everyone want to touch, smell and feel the
fabrics, irrespective of their nationality, ethnic background or age. Apart from factors such as
acoustics, lighting and climatic control, our curtains, carpets and wall- and ceiling-finishes play a
part in the experience of a room, consciously and subconsciously, physically and

7 ibid
psychologically.” The notions that these designers are exploring are interactivity, softening of space and creating warmer more inviting spaces. 

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9 Petra Blaise, Hand tied curtain.
Fashion has evolved dramatically. In terms of women’s clothing, changes in the design process, derived from alternative practices and their dissimilar methodologies, have ‘been responsible for the most exciting changes in shape and cut during the last century. Poiret, Vionnet, and Chanel, sensitive to social and aesthetic influences, ‘promoted the body’ after it had been enclosed in structures for a century.’

Techniques well known by architects, such as the cantilever and suspension, have been adopted and investigated in pattern making/clothing design to construct innovative, engineered forms, and to develop new ideas of how the final garment might be draped or hung.

This comparison of architecture and clothing has a long-standing history. Numerous examples of each discipline have been written about frequently, with reference to the others’ design and construction processes. Numerous examples of designs from each discipline throughout the book, demonstrate how both fashion and architecture can explore the typical methods used by one another, and how they can apply these techniques to their own unique design process.

Clothing designer Yohji Yamamoto has ‘constantly challenged the fashion world and what was expected.’ He is fascinated with ‘volume, structure and transformation.’ His ‘Secret Dress,’ from ‘Wedding Collection- Spring/Summer 1999,’ explores the technique of cantilevering. Cantilevering, along with ‘long languid silhouettes and fluid dresses’ are some of Yamamoto’s signature design elements. He achieves these cantilevered forms by using whalebone inserted into the hems of various garments. These structural elements act as the frame which ‘create gently sculptural forms which undulate with the wearer’s movements.’

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12 Brooke Hodge, Patricia Mears and Susan Sidlauskas, Skin and Bones, 1st Edition (Thames & Hudson, 2006). Page 9
13 Ibid
14 Ibid
15 Secret Dress.
Junya Watanabe, from Comme des Garçons, utilizes the same sort of technique in her ‘Wired dress’ from Autumn/Winter 1998-1999. This cotton and metal ensemble hangs off the hips but sections ‘cantilever’ and protrude out from the body.
Nanny Strada’s practice of clothing design also ‘makes use of rational approaches, structural inventions, and technical processes more often associated with industrial design than with fashion.’

Clothing designer, Yoshiki Hishinuma is renowned for utilizing ‘innovative textiles and creating unusual shapes. His ‘Inside Out 2Way Dress’ was created with the notion of ‘taping’ the dress together using ‘seemingly random strips of opaque’ fabric. This sheer curtain wall of fabric is held in place by a structure of crisscrossing white bands. Hishinuma’s work has ‘prompted an investigation into taping buildings together.’ The Carbon Beach House by Testa and Weiser explores utilizes the technique of taping as a structural frame, which ‘also appears on the outside as if it was just a decorative element.’

Hussein Chalayan’s dresses from the spring/summer 2000 collection, are some other ‘structural looking garments.’ The tulle dresses, ‘appear to be (of) a rigid structure, inflating by four or five sizes the shape of the woman who wears (them).’

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17 *ibid*
18 *Brooke Hodge, Patricia Mears and Susan Sidlauskas, Skin and Bones*, 1st Edition (Thames & Hudson, 2006). Page 37
19 *Brooke Hodge, Patricia Mears and Susan Sidlauskas, Skin and Bones*, 1st Edition (Thames & Hudson, 2006). Page 160
20 Petra Blaissse, Hand tied curtain
These are just a few examples of the use of shelter, structural skins, cantilevering and folding in clothing design and how they relate to architecture. I am interested in researching the typical practices of clothing design and what architects can learn from the techniques used.

Pink Tulle Dress - Hussien Chalayan
Architecture that has been informed by clothing design can be found in architectural works around the world. Herzog’s interest in clothing design derives from his mother exposing him to her tailoring business throughout his childhood. His personal interest in fashion, particularly pattern making and texture, has become apparent in the collaborations of some of his and de Meuron’s buildings. Another example of Herzog and de Meurons’ work, which demonstrates the simple but affective technique of wrapping, is the famous Central Signal Box in Switzerland. This building is known for being ‘wrapped in thin copper strips that twist and bend like fine pleats, serving to ‘dematerialise’ and soften the monolithic structure.’

The most obvious meaning of wrapping in the world of fashion would be the act of simply wrapping a fabric around the human silhouette. Throughout history, fashion designers have experimented with the notion of wrapping to play with deforming and misinterpreting the

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25 Herzog and de Meuron, Signal Box
predominant contours of the body. In accordance with this, architects are experimenting with
the distortion of building skins through new digital technologies to blur the distinction between a
wall, floor or roof. By utilising advances in technologies to assist new processes, architects are
able to reinvent the aesthetics of a typical building skin and how it is realized or perceived by the
human eye.

The adopted strategies that have already been and continue to be explored by architects around
the world, such as pleating, folding, wrapping etc, are all interesting ways of manipulating and
sculpting skins and surfaces. Nader Terahni (Officeda) has exhibited many works of this sort. He
has successfully mastered the art of making a static material appear fluid, such as his installation
‘Rapunzel,’ a waterfall of blonde locks created with the aid of the computer and CNC routed
plywood. Another example is the solid, but fluid curtain type wall of bricks in the Casa la Roca.

26 Nader Terahni, Casa la Roca.
Listed below are some traditional dressmakers techniques, with examples of how architects have adopted the same strategy and applied it to architecture.

**Folding**

Folding, has been adopted by architects as a ‘device to create greater visual interest through dramatic effects of light and shadow on a building’s exterior surface and to manipulate the volumetric forms of the interior.’

This particular technique means a 2D material has the potential of becoming a structural element- i.e. if you fold a thin surface it becomes stiffer and rigid, enabling it to span a greater distance with less support. Folding is one of the essential techniques facilitating the notion of structure becoming surface skin and vice versa.

Folding in the form of corrugations lends thin, low-weight sheet materials a high load-bearing capacity, making them an efficient means of enclosing space. Take corrugated iron for example. A good old simple kiwi material, used to knock up cowsheds and barns, requiring minimal structural support. The corrugations in this sheet material (typically half a millimeter thick), give it an unbelievable structural integrity and capacity to span. Folded steel sheet roofing, with troughs up to 400mm deep, are now being manufactured, which pushes these self supporting loads to even greater lengths. Peter Stutchbury has experimented with such materials in some of his recent works – a sheep shearing station in the Australian outback, and an aircraft hanger (where maximum eaves and minimum structural support aid the functioning of the buildings).

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However, this analogy of folding does not just apply to dressmaking techniques. The principles of thin-plate folding can be found in nature. Palm leaves have longitudinal folds along which fine
tubes distribute nourishment. The folded form creates a cellular cross-section that is rigid yet flexible enough not to break.

Both architecture and fashion are continuously developing new cutting edge materials and structural skins - when structure becomes the surface skin or vice versa, the façade becomes a structural element of the building. This opens up areas of exploration of surface in architecture. It is not bound by the same structural laws, which govern traditional design/construction. Origami is a simple and elegant example of a 2D material, folded and structurally organised into form. FOA (Foreign Office Architects) appear to explore origami and the use of the Hokusai Wave in their Yokohama International Cruise Terminal.
In accordance with this, clothing designer, Yoshiki Hishinuma has constructed a dress using the folding techniques of origami. He has used fabric with origami-like folds to create a honeycomb effect that allows each dress to expand when occupied or manipulated by the wearer.
Toyo Ito and Associate’s TOD’s Omotesando building in Tokyo is an example of the structure of the building also becoming an ornamental surface skin of patterned glass and concrete. This also eliminates the need for internal columns as the surface also supports the floor slabs.
Weaving

Used by fashion designers and adopted by architects through connections of spatial volumes and surfaces of buildings, is “weaving”. This also provides inspiration as to how architecture can adopt a simple method of joining/creating surfaces and ‘complex interlaced interior spaces’.30

Lars Spuybroek’s *Maison Foile* in France is an example at a structural level, of weaving, interlacing, braiding, knitting and knotting techniques. At an aesthetic level, it exemplifies draped surfaces that bend with successive curves in alternate directions. He has said he has a ‘textile way of thinking,’ and by adopting and investigating these methodologies he has been able to push the boundaries, of both the structure and form in buildings.

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29 TODS Omotesando Building
These examples of architectural works demonstrate how the fabric manipulation techniques used in clothing design can offer inspiration to architecture. Now that they have been identified, it is important to gain an understanding of how these techniques are actually constructed. Just how architects use the idea of the “grid” and construction drawings, fashion designers have pattern making. It is a tool in enabling control and manipulation of a fabric, transforming the 2d into dynamic forms.

31 Lars Spuybroek, Maison Folie.
Cut and join flat pieces of fabric to assemble into a three-dimensional garment. Take the pieces of a three-dimensional garment apart and flatten them, to get individual pattern pieces. The relationship between the flat pattern pieces and the three-dimensional structure of the garment never changes. You can create a garment by cutting, moving and reassembling the pieces of a pattern, just like the pieces of a puzzle.

-Tomoko Nakamichi

Patterns are like documents that describe a garment, conveying its structure more eloquently than words. The art of pattern making enables us to create three-dimensional forms out of a flat two-dimensional material. Unexpected shapes and forms can be converted into flat patterns and ultimately into garments.

In clothing design, a pattern may initially be used as simply a design template (a block), to gain an idea of basic proportions. This can then be modified/tailored using techniques such as cutting, pleating or folding onto a mannequin, to create a customised garment that is more personal to the designer. Pattern cutting by adapting shapes from block patterns can be traced back to the middle of the nineteenth century. As the craft developed the basic rules evolved, but rules can be broken or changed if this comes from new creative directions.

On the contrary, a garment may first be produced (without the use of a pattern), through a designer using his or her eye to depict an idea of proportions and appearance, and then pinning, tucking, pleating, or/folding around a mannequin to create the desired look. If so, a pattern would need to be made up from this garment by a pattern maker in order to duplicate the garment and reproduce a range of sizes. Either way, pattern making itself is what allows us to easily replicate something with efficiency. Pattern cutting by (draping on the dress stand) is a means of achieving a shape around the body so that, although the body and body blocks remain constant, there is no limit to the ideas that can be followed through into workable designs. The designer however, must always be conscious that the body is a form. This can be difficult when one has to relate flat pieces of paper to a design that is basically sculptural when it is completed.

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34 ibid
36 ibid
These same principles of pattern making from garment construction can be, and already are to some degree, applied to architectural construction processes. Fabric membrane structures, commonly used on large commercial buildings, use a similar process of cutting out flat pattern pieces and stitching these pieces together to create a tensioned roof structure. A pattern is created in a computer aided design (CAD) program, to fit over the building structure. These drawings are then sent to CNC plotting/cutting machines, which cut the pattern pieces out of a fabric mesh. The pattern pieces are then stitched together, before being stretched over the building structure and fixed down, often using tensioned cables. This method of pattern making allows for the possibility of large curves to be created out of a flat, two-dimensional material. ‘Making a pattern is as fascinating as trying to solve a puzzle.’

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The use of computer aided design (CAD) programs to assist in pattern making becomes quite important when these methods are looked to for an architectural application. They become an invaluable tool for the design process when designing complex and dynamic, forms and surfaces. A CAD program can up-scale/down-scale a drawing or pattern with the click of a mouse, to create miniature models, 1:1 prototypes, and the final design.

**Computer Aided Design**

The computer tools available to us now and their relevance in form generation from a 2D material is a topic written about frequently. Paper allows us to experiment and investigate structures and aesthetic possibilities of 2D materials. Complex shapes and forms are often difficult to translate into build-able architectural elements, however, the digital age has brought with it software and program’s that make it easier for us to develop these complex shapes into simplified 2D drawings. This process could also be referred to as a kind of “architectural pattern making” - drawing on the same processes in the evolution of fashion design/garment construction.

‘The conceptualisation of any architectural form and space is not necessarily contingent on initial or subsequent digital intervention as a route to physical production.’ Program’s such as RHINO, allow the designer to draw the desired three-dimensional form (in the computer), which can then, with the click of a mouse, be transformed into a flat two-dimensional developable pattern. Although, the idea of using computer aided design programs along with pattern making techniques for this particular project, is not to use the computer to help design the pattern as such but to assist in drawing, scaling, printing and cutting the pattern pieces. The traditional, more practical approach of an iterative model making process will be the primary process behind the development for the final product. After all it is traditional pattern making techniques that I am researching and utilising to produce developable surfaces.

**Developable surfaces**

‘A developable surface is a surface that has zero Gaussian curvature at every point. This could be a plane, but it could also be a cylinder, a cone, or any of the many other curved or folded shapes one can make from a flat sheet that is dimensionally stable and cannot stretch, but can be cut and glued. All developable surfaces are ruled surfaces- one of their principal curvatures at every point is a straight line in the surface. Consider the cylinder: the curvature at each point

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is the product of the positive curvature of the circular section and the zero curvature of the straight line of the circle’s extension in the third dimension. Developable surfaces are very significant in architectural design, affording a wide range of shapes that can be fabricated from flat sheet material, and flat materials that will accommodate only limited single curvature.\(^{39}\)

-Jane & Mark Burry in ‘The New Mathematics of Architecture’

The notion of cutting and stitching pattern pieces together is all about creating developable surfaces. The primary purpose of pattern making, in general, is to create three-dimensional form out of a flat two-dimensional material.

There is numerous form finding techniques, which have been, and continue to be explored by architects. Another example of a type of pattern making is the process of ‘dynamic relaxation’\(^{40}\). This ‘... is a method of computational modeling for the form finding of cable and fabric structures. In the example of the roof for the British Museum’s Great Court, this method had to be used to find the structural subdivision of the complex, curved dome into glazed facets. It assumes that all the mass is concentrated at the structural nodes.’\(^{41}\)

The primary objective of this project is to experiment, through an iterative model making process, the art of creating three-dimensional form out of a flat two-dimensional material such as paper or fabric. After some basic draping and stretching explorations, the first experiment

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\(^{40}\) ibid

\(^{41}\) ibid

\(^{42}\) British Bilbao Museum
carried out explores the actual making of a fabric structure, using the techniques of knitting and weaving, as oppose to cutting and stitching a fabric to create form.

1st Experiment – The Making of a Fabric

In 2009, through a digital fabrication elective I investigated the ways in which, architecturally, one could manipulate a fabric/surface to find new forms. The piece was an exploration into the nature and possibilities of fabrics.

Draping was something I initially explored. In order to drape a fabric, you need an object to act as a mannequin. I laser cut a series of Perspex elements, which could be slotted together to create a grid. Some of these elements projected vertically in areas so that if a fabric was laid over the structure it would drape over the vertical elements and “sag” down to touch the grid beneath.

After a series of draping exercises I started to use a fabric with a stretch and see what happened if I stretched a fabric over the same structure. Although this technique proved to create interesting surfaces, I wanted to try and create the fabric itself. I found myself trying to create these same “fluid” forms created through draping and stretching without the use of an independent structure.

I proceeded to investigate this idea by picking up knitting needles. Knitting was a technique I found interesting, the process of creating form using one continuous thread by strategically ‘increasing’ or ‘decreasing’ the number of stitches in a row to create something which is shaped in the third dimension. Using two old fashioned knitting needles I have experimented with a variety of threads to create formal model studies. By simply increasing the amount of stitches, in a specific area of each row, a bulge starts to appear. By doing the opposite and decreasing the amount of stitches the fabric being created starts to “pinch” and fold in on itself. By simply changing the size of needles used with a particular thread, the “fabric” will have a different surface appearance. For example if a fine thread is used with a larger needle (say a number 8 or 10 needle), then the fabric will consist of a soft, loose knit. Whereas using smaller needles (say number 4 or even number 2 or 3 needles) with a thicker thread (maybe a 8ply), will mean the “fabric” created will end up a much thicker and denser close knit.

Although I found knitting to be a useful and elegant way of creating form; I found I was limited in terms of how big I could knit something with the knitting needles available, and the amount of structural strength I was able to obtain from the materials pliable enough to knit with. A knitted surface could act as a skin alone but would most likely need an independent structure to help it hold its form once it reaches a certain size unless special knitting equipment was designed to knit a more rigid thread.
From knitting I moved onto weaving. Weaving allowed me to investigate the notion of creating something “fluid” out of a more rigid or static material, also giving a form the potential to act as a structure as well as a skin. This is the technique I used to eventually create a prototype for a partition wall at a scale of 1:1. Through the manipulation of the weave, it allowed for a simple two-dimensional material (constructed from a continuous thread) to gain dynamic form. With the aid of a computer, a three-dimensional mesh was formed, and measurements between each (3200) vertices precisely plotted/calculated and recorded. The data was then translated into two-dimensional developable information, which was then sent to CNC plotting/cutting machines.

Therefore these studies led to how I could manipulate the actual making of a fabric (the weave) in order to generate form. This allowed me to generate real three-dimensional surfaces with a known form through a simple and traditional process such as weaving (I have referred to weaving earlier in the notes and the Pacific islanders/Maori as master weavers). This is one area I would like to investigate further in my research along with pattern making and other traditional clothing design methods.
This process of using the weave to create three-dimensional form proved to be an interesting study but the actual folding, pleating and stitching of a flat material is an important technique to explore when utilizing pattern making to create form. This led me to a course in pattern making at Whitecliffe College of Art and Design, where we learnt the arts of fabric manipulation and pattern making.
During time, spent learning the techniques of garment construction from a course in fashion design, we used fabric (calico) to practice different ways to manipulate a flat material. Calico is a simple fabric, used religiously by pattern makers as it is easily manipulated into various forms and holds its shape once folded, tucked or pinned etc. Its neutral appearance also makes it an excellent material to investigate/ experiment with different forms. If a designer is trying to produce a pattern for a garment which needs to be draped or stretched to get the desired form, then a softer variation of the fabric to be used on the final garment or a fabric with more stretch can be used to draft up a pattern.

Gathering was one of the first manipulation techniques explored in the course. ‘Gathering converts the edge of a piece of fabric into mini folds bunched together on thread stitched close to the edge. Gathering shortens the fabric at the stitching line. Beyond the gathered stitching, the full extent of the fabric erupts into irregular rolling folds. A field of fabric gathered only at the top drops in spreading, fluctuating folds to a floating, lower edge. When fields or strips of fabric are gathered on opposite sides, variable folds flow unfastened between constricted edges. Fabric shapes gathered all around project loose folds that inflate into the centre.’

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Another manipulation technique we explored was the flounce. ‘A flounce is a flowing attachment that gradually flares and swells from a smooth seam line to flowing edge of rolling waves and folds. It starts as a curvilinear piece of fabric with one edge longer than the other. When its incurved shorter edge is straightened and stitched to a stabilizing fabric, the longer edge develops graceful fullness. As part of a whole, the flounce can be a solo addition, or flounces can be applied in rows that either partially or completely cover the base fabric.’

Of all the fabric manipulation techniques practiced throughout the course, pleating was the most interesting or useful in terms of what it does architecturally. ‘Pleats are measured folds formed at the edge of a piece of fabric where they are secured with stitching. Beyond the stitching, pleats become loose folds that continue the arrangement set at the edge. At the edge, pleat folds are either levelled or manipulated to project. The folds are released in sharply creased order, or they continue un-pressed and modify into softly spreading rolls. After reducing fabric measurement at the source, the full extent of the pleated fabric becomes accessible where the folds are unconfined, all the way to an opposite edge that floats or another edge where the folds are again secured with stitching.’

The act of being able to create a certain amount of structural strength and rigidity, along with the depth and aesthetic appeal of these fabric manipulation studies, has led me to further explore the architectural possibilities these techniques have to offer. Through the process of making small formal models from both calico and paper I have explored various ways in which to manipulate a surface to sheath an arrangement of spaces, creating volumes or tucking in and around areas, which might require more or less light or different spatial conditions/typologies.

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Pleating, as a design tool seems, to me, especially useful in the design of architectural spaces and surfaces. The pleats of falling loose folds, close fitting darts and tucks or folded/augmented forms, are the most aesthetically pleasing and purposeful layers of clothing (as well as being very simple and effective.

An iterative model making process, using 100mm x 100mm squares of calico, was carried out to explore numerous techniques of fabric manipulation (refer to Appendix 1). Although, these studies alone did not show me how they can be utilized architecturally.

When utilizing these techniques of fabric manipulation to create clothing, the use of a mannequin becomes extremely important. A mannequin provides the designer with the ‘building form’ to be eventually ‘clad’ or ‘skinned’ and shows the designer how this garment or ‘skin’ can be applied. As, a clothing designer, needs to experiment with how a garment will react when its hung or draped on the human form using a mannequin; I need to apply the fabric manipulation studies directly to my ‘mannequin’, my building form. This will provide me with the knowledge of how each of these techniques/studies complete and enhance an architectural form or space.

The use of Mannequins

‘Pattern cutting should be used in conjunction with a dress stand. This means that as the design evolves, proportion and line can be checked and corrected’

-Tomoko Nakamichi

After some spontaneous model making exercises, utilising the manipulation techniques learnt, I was able to recognize which techniques I felt could be useful as a building component. Whether

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46 ‘Metric Pattern Cutting for Women’s Wear’ (5th Edition), Winifred Aldrich, pg. 4
or not they had the desired visual appearance and how to create an aesthetically pleasant composition depending on the technique being used. I intend to apply these forms directly to a building form with reference to the site and building programme to see how each of them respond/ react architecturally.

Model making exercises are an important part of any design process as they provide us with a useful palette of form finding techniques. Nakamichi writes about ‘how difficult it was learning pattern-making off the blackboard.' And states, ‘I achieved the shapes I wanted by making miniatures out of paper, flattening them out by inserting lines and cutting them to make a pattern... Playing around with patterns enables us to produce many more designs for couture garments.'

This idea of ‘making miniatures’ of the design product to assist in the design process is something already utilized, religiously, within the architectural design process. The making of small-scale models in architecture is an invaluable tool utilized to acquire the knowledge needed to design good architecture. Evidently, the smaller the scale at first, as with a sketch, the easier it is to gain an idea of basic proportions. Although, larger scaled models are usually made to experiment with the arrangement of space and the engineering of the significant structure needed.

‘As three-dimensional cutting requires a significant level of skill, the method I adopted (for patterns ...uses a half-scale dress form. This makes it easier to understand the overall shape, and to create patterns based on the silhouette of the sloper block (pattern)).’

-Tomoko Nakamichi

The practice of using a mannequin to drape, cut, tuck and pin a fabric over and around the human form is an exciting way to produce a garment and the designer/ pattern maker may need to use their eye to determine what works in terms of shape and fit, of the overall composition and whether or not the garment is going to be visually appealing.

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47 Tomoko Nakamichi, Pattern Magic (London: Laurence King Publishing Ltd, 2010). Page 52
48 ibid
49 ibid, Page 26
The primary purpose of a mannequin in clothing design is to ensure that a garment ‘looks’ good. This idea that a garment ought to be flattering or aesthetically pleasing brings me to the architectural design process and whether or not a building’s proportions and its visual appearance in general are determined by aesthetic appeal. Clothing these days and in our culture, is usually chosen and worn by someone because it might be flattering for the particular body shape. For example it might hide an area of the body, expose an area, accentuate a favoured area or make an area appear longer, smaller or bigger. Whatever a garment or outfit might be doing for a particular body form; the person is aiming to convey a certain message, whether it is aiming to please, stand out, be noticed by others or to conform to others.
‘A major objective when making garments...is not only that they fit properly but that they also look attractive. For this reason, garment design will never cease to exist and provide endless enjoyment.’

-Tomoko Nakamichi

We may ‘dress up’ to impress or ‘dress down’ to appear ‘anonymous’ but we are essentially striving to achieve a convincing façade of some sort. These clothing design techniques can be used to ‘dress up’ a building for the obvious reasons, of sculptural and aesthetic appeal, as well as creating spatial volumes such as circulation areas or a functional buildings. The mannequin helps the designer to create the ‘look’ they are striving towards with each collection/garment.

After contemplating the various ideas of fabrics in architecture, pattern making techniques and designing through the use of a mannequin (the body). I found myself in search of a ‘body,’ a site which needs enlivening, which is crying out for the intrusion of these so called ‘enlivening’ properties my project has to offer to a space. I found just this. A carcass! A decaying skeleton of ruins asking to be ‘fleshed out’ and re-skinned.

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50 Tomoko Nakamichi, Pattern Magic (London: Laurence King Publishing Ltd, 2010). Page 11
Building on Ruins

‘I love, above all, the sight of vegetation resting upon old ruins; this embrace of nature, coming swiftly to bury the work of man the moment his hand is no longer there to defend it, fills me with deep and ample joy.’\(^{51}\)

- Christopher Woodward (In Ruins)

Clusters of ruins are scattered around over a grassy slopes and down to the waters edge of Reotahi Bay. The crumbling concrete walls give an insight into the history of the site, and how man once occupied this place. They are the decaying ruins or ‘skeleton’ of an old meat-works factory. These particular ‘carcasses’ or ruins, provided me the opportunity to re-model and re-skin the existing skeletal structures. I have adopted techniques from clothing design and

construction, as a means of generating form for this particular type of architectural re-intervention.

To preserve the delicate ruins, I have proposed to build over and above the existing walled spaces, allowing some parts of the new programme to intertwine with this existing raw space. The idea of creating light and lofty forms, which ‘hover’ over the skeletal structure, endeavours to be an unobtrusive way of intervening with this magical site, without intruding on its existing unique quality and character. The materiality wants to be in contrast with what is already there. For example Claudy Jongstras’ felt wall in a Public Library in Amsterdam, using wool as a lining material. ‘It’s so surprising to see wool in what could be considered as a harsh environment i.e. the clean, geometric lines of the building...that combination of a sophisticated modern interior teamed with this ancient material.' This idea of contrast in form and materiality is something that I hope to have achieved in this design. The extreme weight of stone and concrete of the ruins, verses the delicate fabric forms lofting above, sitting playfully over the formwork below – defined by the raw geometries that are the bones of the old meatworks.

The concept of building on ruins is no new one, but it amazes me how these types of places seem to fascinate everyone time and time again. We are drawn to them. Ruins have the ability to detach themselves from tangible ideas, and our minds are able to play and imagine what they once may have been (and could be again). With the end of Industrialization and the start of de-industrialization in certain areas there became the need to re-invent/ re-build entire towns, which had died after factories closed down. What is interesting with this type of architecture, is that the existing buildings and ruins for a new site/canvas for re-design.

The city of Rome, in Italy, is renowned for its ancient ruins. Many of these skeletal structures have been ‘... physically pored over, ...imaginatively restored and certainly made use of in various ways in new buildings.’\(^{53}\)

‘*We are apt to praise and form greater ideas of ruins than we should perhaps have had of the buildings when whole.*’\(^{64}\)

- *Joseph Michael Gandy (letter from Rome of 1796)*

Throughout the times of the attempted restorations of ruins in Rome; the ‘ruin as a ruin’ became ‘...a greater stimulus to the imagination of architects than any attempt (of) ...restoration. Lack of interest in using archaeology as a means of creating images of Roman buildings in their complete states, ...corresponded with lack of interest in creating buildings which were literal versions of Roman examples, (and) ...instead, elements of ruined buildings and ornamental details were gathered eclectically to produce new forms for modern-day patrons.’\(^{55}\)

‘*While the eye contemplates the wreck of grandeur, let the imagination effect its restoration.*’\(^{56}\)

- *George Wightwick (on visiting the Forum in 1825)*

Architects and architectural theorists of this time, were passionate about preserving the ‘ruin as a ruin.’ The restorations, which attempt to re-build the ruined building as it was, do not appreciate the existing condition of the ruins themselves and what they have to offer in terms of inspiration for new form. As Pennethorne states in a letter from 1825, about his ‘views on the purpose of restoration drawing’ and ‘literal versions’ of ancient ruined buildings: \(^{57}\)

‘*It is not from the remaining parts but from the study of the ...whole building when perfect that I ought to derive the greatest advantage- for though the drawing [of] the remains is absolutely


\(^{54}\) ibid, Page 26

\(^{55}\) ibid, Page 46-47

\(^{56}\) ibid, Page 46-47

\(^{57}\) ibid, Page 104
requisite yet it is I think secondary & mechanical compared to the exertion of the mind in the former. For the labour of the hand must be subject to the understanding."\(^{58}\)

This describes, ‘the very antithesis’\(^{59}\) of many eighteenth-century architects and architectural theorists, including Joseph Michael Gandy’s, view that ‘greater ideas could be formed from ruins than from the imagined restoration of a ruined building.’\(^{60}\)

Peter Zumthor’s Kolumba Museum in Colonge, Germany, is built over the ruins of a late-Gothic church. The museum illustrates how innovative design can be obtained using an existing site of ruins. Zumthor’s design uses the ruins to its advantage. The building ‘...delicately rises from the ruins, ...respecting the site’s history and preserving its essence.’\(^{61}\) This heavy structure sheaths a space housing the ‘Roman Catholic Archdiocese’s collection of art which spans more than a thousand years.’ Zumthor explained at the museum’s opening how he strived to create a building, which ‘emerged from the inside out, and from the place.’ Zumthor was contracted to design a museum, which exhibits the preserved ruins and art forms/ works; as ‘(the Archdiocese) believe in the inner values of art, its ability to make us think and feel, its spiritual values.’


\(^{59}\) ibid

\(^{60}\) ibid

Apart from the beautiful way in which this new intervention links with the old, there is another fascinating trait that this design offers. The new stone-work that rises above the ruined walls, is in parts perforated (by staggering the bricks) to form a lightweight building enclosure. The weight of the stone is suddenly eliminated, evoking an almost textile like cloak that envelopes the precious archaeology inside. This idea of “weightless stone” is reminiscent of the work of Officeda, and Nader Terrani, who similarly staggers brickwork, and shapes it into fabric like forms.

The intervention with the ruins of Reotahi Bay will be a form of fleshing out and re-skinning of the naked voids, but at the same time the intervention will barely touch what exists. Through the preservation and re-integration, this place will be more available to the public. However, the exhibition of this ancient ‘carcass’ will not be the sole purpose of the building. With a surplus supply of wood chips and pulp available from the Carter Holt Harvey Wood Refinery across the harbor, there is the ability to ferry this pulp across the water where the proposed building will

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62 Peter Zumthor, Kolumba Museum
house the final stage of the refining process – from pulp into paper. Therefore the proposal is a paper mill, and the re-introduction of industrial factory spaces, which will float over the ruins will function as a boutique ‘paper mill.’ This process of refining wood products into a mass produced product, is similar to the meatworks that once occupied the site – the refining process of a raw material into useable products.

Factory Architecture

The site is situated at the entrance to the Whangarei Harbour, across the channel from Carter Holt Harvey (CCH). CCH is an established factory for producing timber construction materials (especially laminated veneer lumber), but also refining some of these materials down to paper and cardboard and finally transporting some of these materials to their other factories to produce paper products such as card board and linear board boxes. A proportion of the logs they de-bark are made into wood chips, which are either sold as wood chips or further refined on site at CCH to produce pulp. I propose to transport some of this pulp by barge across the harbour to the site, where it will be further refined and processed into paper.

The entrance to the Whangarei Harbour is on one hand a tranquil picturesque landscape, but on the other it sports a major industrial precinct – mainly being New Zealand’s Oil Refinery. The paper mill proposed will be a ‘boutique’ factory in contrast. The site can be accessed only by foot or sea at the moment. A walking track meanders through the back of the site along the top of the hill with a number of walkers passing through the site each day, on the coastal walking track to the Whangarei Heads. The Paper Mill is something that is possibly a foreign idea in today’s perception for a site such as this. Some may think the place should be preserved, and made a reserve, but the power of the building will endeavour to ‘make’ the site more that it currently is.

Factory Architecture really got going with the technological advances of industrialization. With the ever-expanding use of machinery, the commercial industry required an influx of large spanning factory spaces. Architects explored the notion of creating a diverse range of large box-like forms, to house the large industrial machinery. ‘The building type which exemplifies much of (Factory Architecture) ...up until the early 1980s, such as the PA Technology Centre by Rogers, and the Sainsbury Centre for the Visual Arts in Norwich by Foster, was the so-called ‘Hi-Tech Shed’: a large-span, rectangular structure composed of interchangeable elements arranged on a regular grid to maximize flexibility. Although most component systems were made to order, the use of a regular grid combined with new production techniques, reduced variations sufficient to achieve the required economic production runs.’ Structural systems often informed the design,

as does the box forms of the paper Mill. The main box is effectively a large truss system, reminiscent of a crane arm, allowing for great cantilevering and open workable spaces.

"While (some) European designers brought a much needed commitment and professionalism to their working relations with industry, their own early perceptions of what was possible with advanced production technologies remained strongly influenced by orthodox Modernist ideals of standardization."\(^{64}\)

"Significant shifts in the technical and economic constraints of industrial prefabrication are emerging through the development of digitally mediated drawing and manufacturing technologies such as CADCAM. Prefabricated components can be mass-produced offsite, with variable or differentiated configurations without significant extra cost.

These technological developments have design implications that cannot be adequately accounted for solely in technical terms. Developing criteria for engaging with prefabricated differentiation is an emerging design problematic. Anachronistic cultural questions regarding the role and status of ornament also take on renewed relevance. Standardisation prefabrication was co-opted by modernist theory to promote cultural progress towards universal standards through a reductive logic of economic efficiency and technological progress." For example, "for Walter Gropius, standardization provided a means to further develop Adolf Loos’ cultural and economic argument for progressing beyond ornament."\(^{65}\)

I will be developing the typical box like form, a common form found in many types of Factory Architecture, to house the paper making machinery. The machinery itself, and the circulation of workers and the public, will be the primary factors generating the form of this functional box.

With the design of factory spaces being primarily ‘program-led’ rather than ‘form-led,’ the building should be exempt of potential ‘difficulties with fitting all the complex function’s of the factory machinery into the building form.’\(^{66}\) The general form of the factory space therefore, will be functional. In contrast to this, the areas where the public can interact with the factory will

take shape – through enveloping skins and meandering walkways that take you in and out and through the spaces.

**Massing by Adding ‘Fat’ & ‘The Functional Box’**

The paper making machinery requires a long, narrow, straight, open space. The middle section of machinery needs to be boxed in/ covered with a hood and acts as a drying room where heat-treated air is circulated to speed up the drying process and then exhausted via venting systems. From functional requirements of the machinery the design is essentially a linear box, which runs along the north/south axis of the site. Where this rectangular box glides over the middle section of ruins, the traced outline of a section of ruin is extruded, forming the drying tower/chimney. The benefits of the open-plan layout is the ability for re-use of the space, or adaptations at a later date (just as the ruins are providing this design).

This massing, and ‘fleshting out’ of the existing skeletal formwork, is where the ‘fat’ needed to create the body of the building is added. To fully utilize the adopted strategies which will produce the building skin; the skin requires a kind of spatial depth, a bodily mass - fat. ‘Fat occurs in the sexual organs; without fat we have no sexuality and therefore no reproductive capability. It hardly needs adding that it is fat that we crave when we discuss architectural taste.’

The interaction will take place at the circulation core – the central form extruded above a part of ruin. In this void, the paper machinery will rise. From outside, one will view the internal workings of the building, the engine room if you like, through this translucent vertical core. Around it will wrap an access and walkway ramp. This ramp, starting at ground level, will trace the outline of this ruin space below, and the vertical core, wrapping its way up and through the building. As it penetrates the box form, it will take you inside, and pass under and over the machinery allowing a total experience of the process.

**Skin**

*Skin*—*the human body's largest organ is the sack of dead and living cells that acts as our environmental envelope, protecting against the elements, against injury, against infection and (importantly) against every other organ escaping from that field we call ‘The Body’...Skin is the invisible organ because it is visible, and its visibility is contingent on a categorical separation between seeing and touching. Skin may be visible, but it ‘sees’ through its tactility. Skin is fundamentally different from our internal organs. The latter can be surgically removed leaving behind an intimate space, while the former is stripped from its support, which has the twofold*

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effect of producing a flaccid simulacrum and a nude frame. The skin is not a surface but a primary architectural state. It encapsulates by defining a space that cannot otherwise be classified as complete. That it is discussed as a surface is symptomatic of our inability to accept that a plane can be measured with a volumetric quotient. Yet the skin is not simply a structure for the functioning of the body, it is also a fundamental sensory organ and it contributes to the delineation of a body in the phenomenological world. Skin is therefore a spatial filter between states, demarcating proprieties of interiority and exteriority - the traditional responsibility of architecture.68

I have adopted strategies taken from clothing design and construction to enhance a buildings skin and functionality, which directly effects the internal environment in a unique way and creates the microclimate necessary for housing the drying machinery. The horizontal box intersects the bottom section of the vertical box on a slight angle. This creates an intricate connection between the two boxes and creates the opportunity for detail designed in clothing the ‘joints’ of the human body. An example is a sleeve opening, joining the torso and arm opening. These joints or openings in clothing design are often used as an opportunity to decoratively and intricately detail a seam or opening.

After various model making exercises, I came to the conclusion that an effective technique was to treat this floating building form as my mannequin which I could then drape, pin and tuck the skin to with reference to the ruins and site below. The mannequin is made up of a foam box, which is clothed in a fitted calico layer. The horizontal box is wrapped in black calico and the vertical (drying tower or chimney) wrapped in the natural raw cream colour to define and accentuate the connection of the two forms. The notion of enhancing a joint/ opening is first creating a close-fit, block pattern to fit the two boxes and then explore the different ways to ‘celebrate’ the connection/joint, which occurs between the two forms, by pinning calico ‘skins’ to my building mannequin. A series of different configurations using fabric manipulation techniques out of small rectangles of calico have demonstrated how pleats, folds, darts (and many more) can sheathe a building form whilst creating volume, opportunities for openings and interior/exterior spaces.

By creating a block pattern, which is tailored to fit the connection of the two ‘box’ like forms, it is then possible to adapt this pattern on a mannequin as needed. The iterative model making process used to adapt this building skin ‘block’ will be utilized in conjunction with a mannequin to finally produce a skin that works for the building and its occupants. ‘There is no one prescribed way for how (patterns) are made. The history of clothing began with the wrapping of a piece of fabric around the body, so you should let your mind be free and approach the making of garments with a sense of fun. Ideas for garments are arguably infinite.’69 Therefore, the final

69 Tomoko Nakamichi, Pattern Magic (London: Laurence King Publishing Ltd, 2010). Page 103
skin produced to dress the factory will be just one proposition of many others for what it could possibly be.

By using a translucent material such as a PVC membrane to create the tailored building skin, the tower will have the ability to ‘glow’ in the dark and become a signifying element. Basic planning, heating, venting, and shading requirements will help to generate the final skin but the method used to develop this skin is the building mannequin. This mannequin will be the secret to creating a beautifully tailored building skin.

Looking at the site and its context, the climate, sun, prevailing wind and rain conditions will determine what the building requires from each independent façade. Firstly, the objective is to create a microclimate for the drying tower/chimney. Therefore to exploit the energy from the sun, the north facing façade on the rear of the site is orientated to catch the optimum light. The potential for opening up areas of the building skin, also provide the opportunity for the drying tower/chimney space to sprawl out onto the roof of the horizontal box; with pockets of sun filled outdoor niches. The opposite side of the tower (south façade), faces the harbour and requires minimum thermal loss, but still requires translucency for viewing. After looking at formal model studies used on the building mannequin, I have managed to create a type of double or triple skin, trapping and storing any heat. Doubling up the fabric and using orderly ‘box pleats’ creates multiple layers to ensure enough heat is stored inside the tower, whilst creating an interesting form. As the south façade also needs to shield the building from prevailing winds, these pleats and rolling folds also provide the façade with slotted areas for protected openings/natural ventilation and additional light when and where required. The tall rolling folds of this southern façade will be viewed from many vantage points; especially from across the water and with the shipping movement within the harbour, it will act as a beacon for ships and boats.

“Skin is not hide nor covering, camouflage, uniform, adornment. It is a surface of exposure, zone of susceptibility, of vulnerability, of pain and abuse.”

There are two fundamental ideas that this skin has to offer in this design. The skin fulfills the functional requirements. But the sculptural and aesthetic qualities of the skin also have a function. Elements of design in architecture as well as in clothing design, if successful, have an everlasting and memorable effect on our emotions. As clothing designer Tomoko Nakamichi wrote, ‘garments we design ourselves appeal to the emotions as well as the eye.’ This is relevant in terms of our perceptions of architecture as well. The perceptions of each space need to be for-seen to ensure the factory is a positively inhabitable building. Just like somebody will only wear and make total use of a garment when they feel comfortable wearing it, it is important the proposed addition of inhabitable spaces are agreeable, welcoming and complimentary.

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Therefore studying the typical human perceptions of spaces will assist in the making of a potentially ‘moving’ atmosphere.

I would like to believe there are pre-defined methodologies describing how to design good honest spaces that will generate positive atmospheres for the people who will experience them. Through site analysis (including noise, temperature fluctuations, colours, textures, patterns), one can identify the latent atmosphere that is inherent of a particular place. Then, through the insertion of architecture – one can add further dimensions to these atmospheres, while harnessing and enhancing the experiences that already exist.

The existing ruins of my site are carcasses, decaying skeletons begging for an architectural insertion that is the ‘fat’ that will re-activate the place. Peter Zumthor speaks of architecture quite literally being a bodily mass; something that has an anatomy and that can literally touch him. This anatomy and fat is my architecture. It is needed to activate the existing latent atmosphere that I can see, and to harness and enhance the existing conditions, making them tangible experiences to others.

Sound is an important factor worth taking into consideration in factory architecture. Paper machinery is anything but quiet and by situating the factory on a tranquil site of grassy slopes at the waters edge, I hope to capture some of the tranquil energy and translate it into positive interior spaces. ‘Interiors are like large instruments, collecting sound, amplifying it, transmitting it elsewhere. That has to do with the shape peculiar to each room and with the surfaces of the materials they contain, and the way those materials have been applied.’ 72 By no means am I aiming to create silent factory spaces, but instead will focus on the transition from the tranquil outdoor setting to the whirring on goings of the interior factory space. ‘The most beautiful things generally come as a surprise.’73 The transition from the mute site to the inevitably clamorous interior, experienced through sound differences, will promote an awareness of the buildings obvious but unobtrusive presence.

'Snap your fingers, and the space responds. Whistle a note, and the space returns one or more echoes. Sing a song, and the space emphasizes particular pitches. Remain silent, and the space remains silent.’74

By utilising materials with the ability to ‘dampen’ or ‘buffer’ the noise of the machinery, the internal spaces will become that of an enlivened building. The soft echoes of the whirring machinery, the sudden clanks of workmen moving all play a part in making the factory an

73 ibid, Page 33
74 ibid
inhabitable space. ‘There are buildings which have wonderful sounds, telling (us) we can feel at home, (we’re) not alone.’ The ongoing movement within each of the spaces is a response to the enlivening of the ruins and will foster the honest intrusion of a new ‘somebody’ to the site.

Because paper is produced at a rapid pace through draining and drying, the temperature of the factory space in this drying section is controlled to assist in the drying of the paper. A change of temperature also has that element of surprise and has a tremendous impact on our experience of a space at any given time.

‘What comes to mind when I think of my work is the verb ‘to temper’ – a bit like the tempering of pianos perhaps, the search for the right mood, in the sense of instrumental tuning and atmosphere as well. So temperature in this sense is physical, but presumably psychological too. It’s in what I see, what I feel, what I touch, even with my feet.’

-Peter Zumthor

Studying the body and architecture is an important part of the design process, in terms of how the body reacts to the design of the building. ‘We perceive atmosphere through our emotional sensibility – a form of perception that works incredibly quickly and which we humans evidently need to survive...something inside of us tells us an enormous amount straight away. We are capable of immediate appreciation, of a spontaneous emotional response, of rejecting things in a flash.’

Incorporating the analogies of things such as sound, and temperature and how the body and mind perceive these qualities, within the design process, will assist in creating a building which not only responds to the ‘behavioural and ergonomic’ body requirements but also the emotional capability. Therefore, the design process will be based on function and the belief that ‘we shape our buildings and afterwards our buildings shape us.’

‘The philosophical alienation of the body from the mind has resulted in the absence of embodied experience from almost all contemporary theories of meaning in architecture. The overemphasis on signification and reference in architectural theory has led to a construal of meaning as an entirely conceptual phenomenon...The body, if it figures into architectural theory at all, is often reduced to an aggregate of needs and constraints which are to be accommodated by methods of design grounded in behavioral and ergonomic analysis.’

-Kenneth Frampton

75 ibid
76 Peter Zumthor, Atmospheres (Basel: Birkhauser, 2006). Page 35
77 ibid. Page 13
The occupants of the proposed factory spaces will experience a positive emotional reaction. The study of the body, mind and architecture will ensure the building itself will determine how we experience each space emotionally as well as ergonomically.

'We shape our buildings and afterwards our buildings shape us.'

-Winston Churchill

After many iterations of the ‘skin’ element, through fabric manipulations over a mannequin model of the factory forms, the final skin is an adaptation of the form of the simple pleating technique, as seen on pages 18 of Appendix A. The ‘Pleat’ is an effective architectural idea as it is comprised of simple shapes re-formed to give shape and volume to a surface. The simple pleated surface, while providing dynamic shape in elevation and plan, lacked form and useable volume in section. Therefore these folds were broken up into pieces and re-shaped and re-assembled creating a Jabara type form. The introduction of a crescent shape curve to the individual elements, provide volume to the section. The Jarbara acts like an accordion, where the creator can control the volume and depth of the space beneath the skin by tensioning ends of the skin. Refer to Appendix A for examples of the Jarbara, and its application on the mannequin.

In conjunction with this Jarbara form, an underlying flat panel with a simple dart feature wraps around and behind. This not only forms a backdrop to the main skin element, but it provides the second and third skins or membranes of the building, controlling climates and providing individual temperate climates within the skinned spaces.
This project has investigated how the methods and processes of fashion and clothing design influence the design processes and solutions of architectural problems. It has been a response to 'How can the methods and processes of clothing design be utilized to enhance architecture?', being the research question of this project.

The particular methods and processes adopted from clothing design are patternmaking, fabric manipulation techniques and the use of mannequins. These have provided a new typology for the formal research—an iterative form-finding process driven by the drawing and making and re-drawing/making of patterns and fabricated surfaces.

The adopted methods, in particular pleating and folding together with pattern making, have proved to be constructive form generating tools. The abstract realm in which these formal techniques were investigated (repetitive manipulations using a constant original shape, and the building block as a mannequin) have allowed the design to progress freely without being restricted to particular constraints—such as site, space etc. This form finding process then provided a number of surface techniques that were then applied to the brief of the project and its particular contextual and climatic constraints.

The beauty in this process is the possibility for re-iterations; similar copies can be made by making small adjustments to the base pattern. Complex three-dimensional forms are easily constructed from simple two-dimensional materials such as fabric.

The role of the mannequin in the design process has proven an extremely effective tool in the creation of unique and innovative forms. It provides a base, on which a buildings skin can be intensively and thoroughly designed and manipulated. Iterations can be made, and alternatives explored. The performance of a buildings skin is extremely important, both for functional and aesthetic purposes. What this mannequin technique adopted from clothing design and provides to architectural design, is the opportunity to thoroughly explore the building envelope in an innovative way.


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