

# REINVENTING THE TENT

*An exploration of fabric construction*

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A 120 point thesis submitted in partial fulfilment of a Master of Architecture (Professional) degree  
School of Architecture, Victoria University of Wellington  
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**Thesis issue:** The lack of beauty and comfort in the modern tent.

**Thesis aim:** To explore and realise a greater potential for the tent.

**Thesis question:** How can the fabric construction and spatial aesthetic of the tent express beauty and comfort?

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## THESIS SUMMARY

The tent is not the shelter it once was. Once, many people found it the central focus of daily life. Now, passing through the passage of culture and time, it has become a mere shell of itself, stripped to the most basic provisions of amenity and comfort.

*'Reinventing the tent'* looks at the tent as we use it today, and asks why this lightweight structure, for all of the advances in textiles and tensile technology, has become no more than a shelter for temporary events.

A case is made for the architectural beauty of the tent, resulting in an exploration of its unique spatial essence, the fabric of its construction, and of its functional use. This then informs a range of tent designs, rich in expression and comfortable enough to once again call 'home'.

For the important role that the tent once played in the livelihoods of many people, the results of this thesis hold great potential for the way that we use tents in the future, and to redefine perceptions of austere simplicity toward realisations of refined beauty.



Design image.

## FOREWORD

I first became interested in tents before I began my architectural studies, when I went over to Europe and lived in one, traveling around by bicycle. On coming home to New Zealand I found that I had enjoyed the experience so much that I continued to stay in one in the back garden.

When I moved to Wellington for university, I shifted into a busy inner-city flat. But, in my second year I began to question how I could be more involved in living my own personal architectural experience, and moved out of the flat and into the forested town-belt with a square of blue tarpaulin. A few months later an opportunity arose to move into a tipi on the outskirts of town, and with winter coming on I took it. I'd stayed in yurts while in Europe, but in the tipi I began to understand the beauty of living in a *supple* structure.

In my third year of study I realised that a tipi is not particularly suited to the wet and windy climate of Wellington. So I collected together supplies of bamboo, water-proof covers, woollen blankets, wooden pallets and a fireplace, and set about building my own shelter; raised off the ground, insulated and comfortable.

I've lived in this tent for more than three years now, and the process of building and the daily experience of living have taught me a great deal that has complemented my architectural studies. My home reminds me of the weather outside, of the season and the time of day. When I want to make more space I stretch the cover out further and build more. When it's cold I add more insulation, light my fire, and feel cosy. My home has taught me the joy of being personally involved in sheltering myself, and it has taught me about a home that always keeps me aware of my surrounds, but while still feeling comfortable and safe inside.

My home is part of my life, and not just a shelter for it. This is the experience that I wish to share in this thesis.

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## ACKNOWLEDGEMENTS

To the infinite number of people who have provided inspiration for this thesis,

To those special people who have helped me build and live in a tent,

To Ma and Pa,

Thank you.



Author's home.

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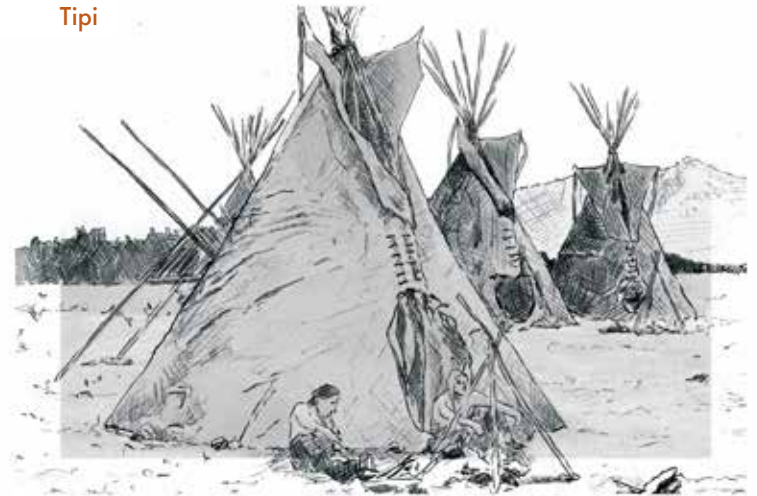
## APPENDIX

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Dome



Tipi



Black tent



Yurt



Different types of tents, historical and modern.

Bell tent



Camping tent



Pavilion



Marquee



INTRODUCTION





The camping tent is both flimsy and lacks the provision of a high level of comfort.

## THE ISSUE

Tents, as we know them today, are the sleeping pods used by weekend campers, they are the crisp white marquees swiftly erected for celebrations, they are the cost-effective shelters set up after home-destroying disasters and they are the grid of green canvas units used by the military as they advance into foreign territory. The tent of the present day finds extensive application - easily transported, easily set up and easily adapted - it makes itself useful by meeting many practical requirements that other, heavier structures do not. And it continues to become ever more useful as developments in new materials make it more and more efficient. But for all of the development that the tent has undergone, it has lost something important to its own very essence along the way. The modern tent has lost its ability to inspire real *delight*.

The tent is not the shelter it once was. Once, many people found it the focus of daily life. Now, passing through the passage of culture and time, it has become a mere shell of itself. In the pursuit of maximum efficiency, it has been stripped back to the most basic provisions for amenity and comfort, and due to this our interpretation of just what a tent is, is different to that which it once meant for our nomadic ancestors. Through our personal experiences of weekend camping trips, we may associate tents with simple shelter. However, through a lifetime living in a yurt, the Mongolian herdsman would have understood something very different. Instead of the bare basics, he saw a tent as the basis for a free roaming lifestyle, as a shelter that provided an invigorating awareness and connection to the land that nourishes, and as a vehicle for awareness of the seasonal shift of time; watching his home move, change, die and be reborn.

Although modern tents successfully meet the practical purposes for which they are designed, they are hardly the type of structures that many people would now enjoy living in - and this is a reasonable outcome, as they are no longer actually designed for long-term inhabitation. Whereas once tents were intended for daily use, now they are used only in situations where the need for shelter is of immediate and of short duration. This change is that, while the tent has always been 'temporary' in regard to its transportability, the tent has now also become 'temporary' in the way that it is used; shifting it from an *on-going* to a *one-off* function. Without constancy of use, modern tent design has focused primarily on the *efficiency* value of fabric construction - the practical attributes of light-weightedness and of support-free wide spans - and in doing so the beauty and comfort that are also inherent to fabric have been overlooked or removed. The modern tent has lost its ability to provide for the more subtle aspects of daily needs, and so we have lost a unique type of shelter.

## Thesis aim

The aim of this thesis is to explore and develop architectural qualities that have been left dormant in the tent, with the intention of restoring an appreciation of beauty back to it along with its ability to also meet the requirements of daily use. Through gaining an understanding of fabric construction, this thesis will 'reinvent the tent' through new design to reveal a greater potential for tents as shelters that can provide comfort and furthermore can inspire delight.

This purpose will seek to use architectural meaning intrinsic to the nature of the tent, rather than to develop it through inspiration that comes from elsewhere outside its own immediate form<sup>1</sup>. It is aimed that the outcome of this thesis is a wholly new interpretation of the tent - however based on its own fundamental and latent expression - that redefines associations of primitivism or simplicity toward perceptions of refined beauty.

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1. Such as using a metaphor of 'skin' or of 'clothing', or a theory such as Avrum Stroll's philosophy discussing the meaning of a thin 'surface'.

## The design project

The design project that accompanies this thesis is a return to the principles that shaped the first tents - in functional use as a 'home'.

Through designing for the needs of a home, considerations that extend beyond the short-term *efficiency* valued in current tent design will arise, leading to a greater realisation of the architectural potential of fabric and of its suitability for daily shelter. However, although design will indeed plan for amenities of domestic function, the main focus will be the expression of fabric's *aesthetic* and *emotive* qualities. In this way - rather than getting caught detailing purely functional practicalities - the thesis purpose will be maintained; of developing an appreciation for the greater potential of the tent's fabric construction.

This brief will test of the ability of the tent to convey beauty and to fulfil meaning. Design will be used to explore the psychological and visual value of curvaceous tensile forms and to discover the spatial atmosphere that comes from fabric's tactile softness and permeability. The expression of beauty which is sought is that which is deeper than a cosmetic of surface decoration, but which instead comes from an overall harmony of form; of providing a meaningful spatial experience and of comfortably satisfying emotional expectations related to use.

## Research method

Research undertaken through this thesis is wide in scope, done so with the intention of gaining a holistic understanding of the tent, rather than a detailed but isolated view of any singular aspect. This approach is taken as it is recognised that the tent is a unified form in which its construction and structure inescapably defines its expression, so that divergent research tangents must be combined to arrive at the intended outcome. Many literary sources are drawn upon; from *engineering* to *anthropology*, and from *psychology* to *trade magazines*. Many websites have also been looked at; searching for businesses that provide contemporary parallels. Design itself has also been an element of research, testing and revealing the thesis hypothesis, and directing further research. This has been a wide ranging and explorative process of inquiry.

The thesis that follows has arranged the array of research into sections, applied where relevant to theory and design. As much as possible I have made my own original conclusions and interpretations, speaking from personal experience, then using precedents to explain and back this up.

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## Thesis relevance

‘Reinventing the tent’ aims to make the tent a more meaningful shelter than it currently is. The relevance of this is the development of a type of construction that has otherwise been marginalised by singular consideration of its practical virtues.

The intention to develop the architectural quality of the tent is an avenue that, through the course of this thesis, has not been found similarly elsewhere. While there are many examples where the spatial quality of the tent has been intentionally applied to other more solid constructions, next to nothing has been done to develop the aesthetic appreciation or the personal comfort of the *true* tent. No examples that match the focus of this thesis were ever found through research, the preference for the tent’s *efficiency* having instead overlooked any development of its *beauty* or *meaning*. By increasing our understanding of the architectural nature of the tent, this thesis has direct relevance as a ‘contribution to knowledge’.

The implication of this research is the development of a currently unrealised type of shelter which may be of benefit to the way that we live our lives. And while this thesis steps aside from the practical efficiencies of the tent, it is still valid to remember the range of unique advantages that it offers, especially as a home: Its lightweight transportability allows it to be built on unstable or delicate landscapes, it has a simplicity that invites the owner into its construction, it has an economy of materials that make it affordable and sustainable, and it has a duration of use that meets the movements of many modern lifestyles. By developing the form of the tent, this thesis serves to make these practical qualities all the more attractive; packaging them within the beauty of architectural appreciation.

The potential of the tent may be seen to be already recognised by people who choose to live in traditional forms such as tipis or yurts<sup>2</sup>, which - with no modern counterpart filling the same niche - find enduring use dispersed around the world. However, although refined to meet the factors of their origins, appropriated traditional tents do not necessarily directly translate to meet cultural expectations in the Western World. With no spatial separation and the amenities of electricity, running water and ablutions often awkwardly incorporated, these tents are limited to whom they appeal. However, far from suggesting that tents are inappropriate for Western lifestyles, this issue instead describes the tent’s lack of recent development and of the market awaiting it to undergo new design.

For the important role that the tent once played in the livelihoods of many people, the results of this thesis hold great potential for the way that we use tents in the future, and of how they may benefit our lifestyles.

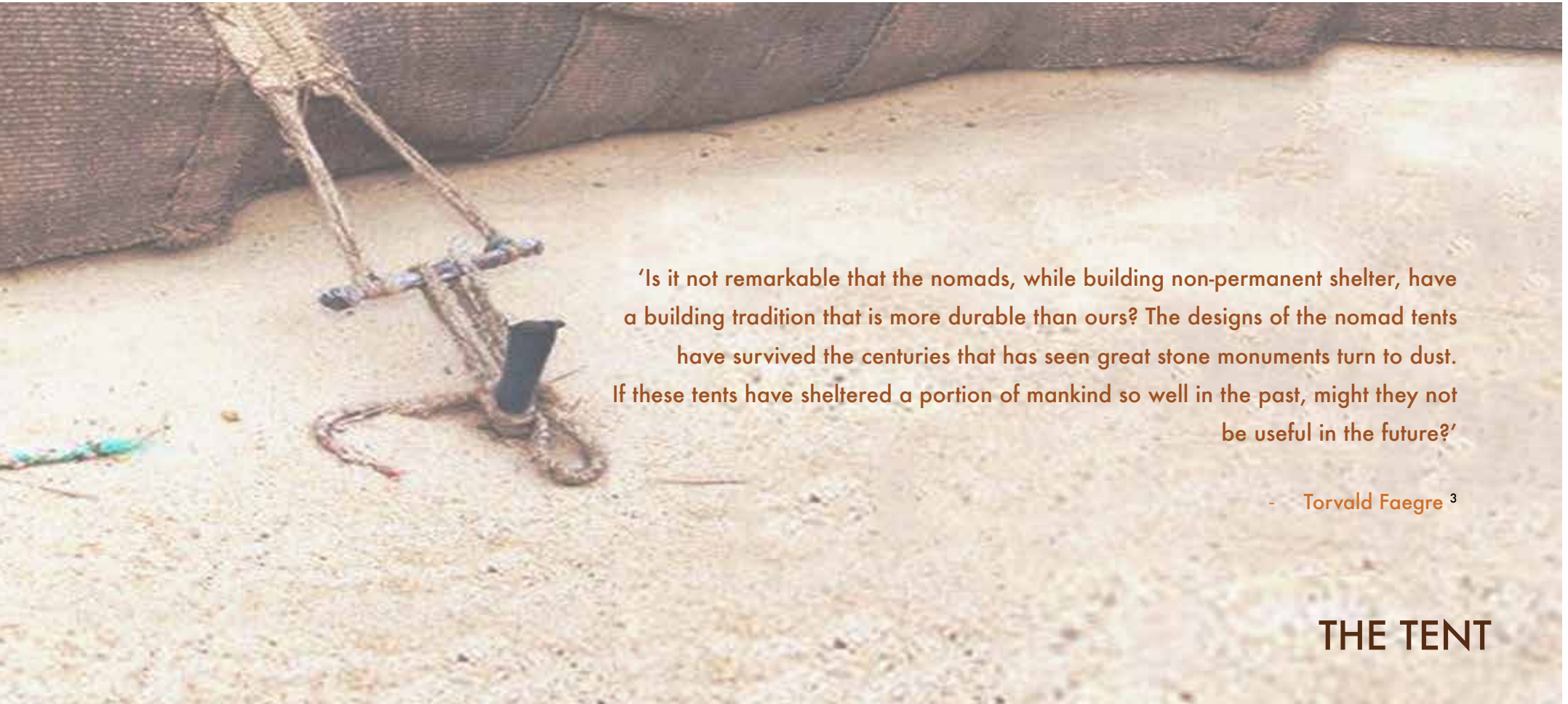
2. See for instance: Kemery, Becky. *Yurts: Living in the round*. Utah: Gibbs Smith Publisher, 2006. Or also: King, Paul. *The complete yurt handbook*. U.K.: Eco-logic Books, 2002. These books are references for living in a modern canvas yurt.



Pegs of a Black Tent.

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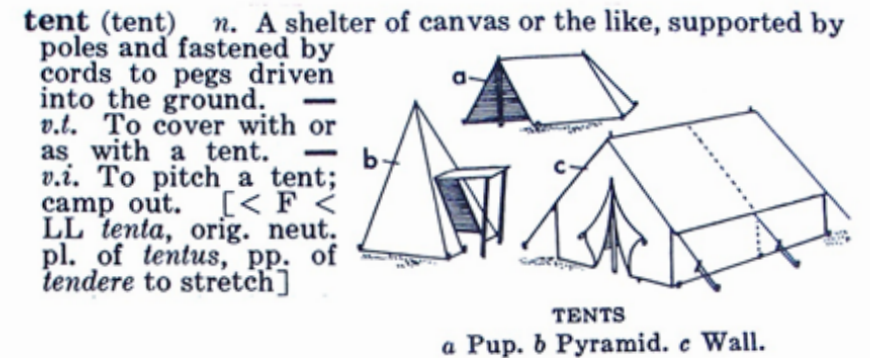


'Is it not remarkable that the nomads, while building non-permanent shelter, have a building tradition that is more durable than ours? The designs of the nomad tents have survived the centuries that has seen great stone monuments turn to dust. If these tents have sheltered a portion of mankind so well in the past, might they not be useful in the future?'

- Torvald Faegre <sup>3</sup>

## THE TENT

3. Faegre, Torvald. *Tents: Architecture of the nomads*. New York: Anchor Press / Doubleday, p. 3. [This has been a major reference for understanding traditional tents.]



## WHAT IS A TENT?

The range of forms that we identify as being tents is diverse, as is the range of cultures and environments that they are found in. It was in some of the harshest climates - where one would expect to find anything but the thinnest of constructions - that the tent found its birthplaces. From the heat of the Saharan Desert to the frozen reaches of the Arctic; the tent has many different appearances as it responds to factors of environment, available construction resources, and of use. The tent is not limited to a single form. 'Tent' is a general term, which is used to describe a light-weight and transportable method of construction, the distinguishing feature of which is the use of a flexible membrane as a covering skin.

The origin of the word 'tent' comes from the Latin 'tendere', which means to *extend* or to *stretch*<sup>4</sup> - similarly as it also does in the word 'tension'. All tents use tension in some way, either in their covering skins, in guy-lines or in containment ropes. This common structural solution comes from the search for the lightest weight structure possible, so as to ease transportation. Tension, an extending direction of force, requires only minimal thickness in order to resist considerable loads, and can span great distances with minimal bulk and only a few compression loaded supporting poles. Furthermore, tensional components are flexible, and can be easily folded up to be moved about.

4. Funk and Wagnall's standard desk dictionary, Volume 2 (N - Z). USA: Lippincott & Crowell, 1983 Edition: p. 697.

Tents are characterised by *responsiveness*. This is true not only of the forces which shape them, but also of the experience that the shelter provides:

Tents developed as a *response* to living in a marginal environment, where a limit of available resources required the creation of a minimal shelter. Then, as a nomadic lifestyle necessitated movement from one place to another, the tent proved *responsive* again - meeting the needs of its user by being folded for transportation and adapting to fit different locations and different functions. Finally, even the spatial quality of the tent is *responsive* - its skin cover having a flexibility and permeability that move, shift and *respond* to wind and to light.

*Responsiveness* is an inherent quality of the tent that will be explored further through this thesis.



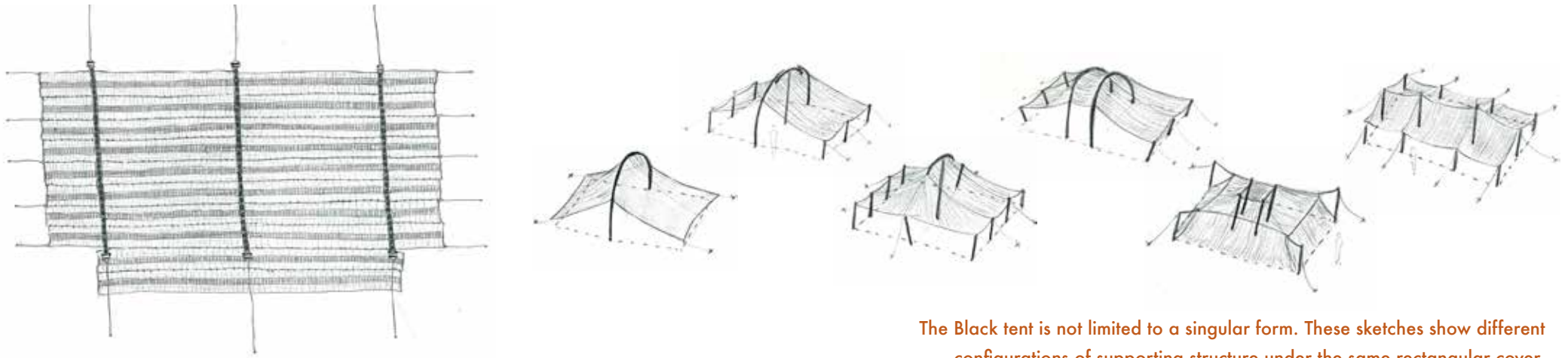
Nomad's camel and packaged tent skin.

## FORMS OF THE TENT

Forms of the tent are often not distinct, with variations within one type often showing similarities of aspects of another. This can lead to blending distinctions between tent forms, and sometimes even means that to their names become interchangeable.

Links between different types of tents can come about through both direct contact and influence, and also through independent development. On one hand, the tent's nomadic use means that it is readily introduced across vast distances and into new cultures; transporting forms from one area to another. But on the other hand, tents from geographically separate cultures can also display similarities in form without direct contact. In this case it is again nomadism that has shaped the tent, but instead of as direct transmission, it is as a common solution in response to a common lifestyle need. In this way it may be seen that similarities between different tents come about simply by the fact that their shape is inescapably influenced by principles of tensile structuring. The tensile form of a flexible skin supported by hoops or poles largely creates dome and cone shapes, so that *all* tents have the same basis geometries. Thus, as distinct forms of tents develop and evolve, similarities or cross-overs in appearance are intrinsic to their structure, these factors being more globally universal than factors of cultural transmission.

On the following pages is a description of the most distinct forms of tents from history and contemporary times.



The Black tent is not limited to a singular form. These sketches show different configurations of supporting structure under the same rectangular cover.

SIMPLE DOME



COMPLEX DOME



HOOP TENT



TUNNEL TENT



MARQUEE



TIPI



YURT



BELL TENT



PAVILLION TENT



SQUARE FRAME TENT



BLACK TENT



WEDGE TENT



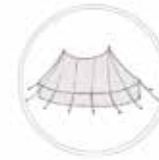
WALL TENT



TURRET TENT



BIG-TOP



Similarities and evolutions of structure or form can be noted down (and sometimes across) this diagram.



## [ FORMS OF THE TENT ]

## Past tents

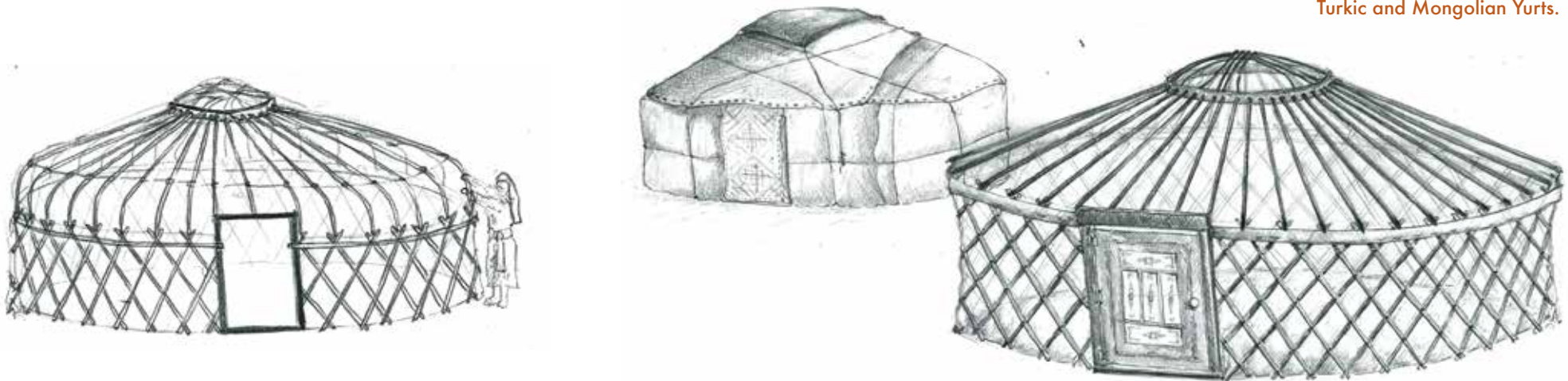
**Dome:** The dome tent is a hemispherical framework of curved sticks, wrapped in a skin cover. This method of construction forms a variety of designs, which are found over a number of different cultures. To the Alaskan Inuit it is known as *yaranga*, to the Turks as *alachigh*, to the American Indians as *wigwam* or *wickiup*, and to the Gypsies as *bender*. In cooler regions the cover is pulled tightly down to the ground to create an insulated cocoon of warmth, whereas in warmer climates the cover is lifted up to create a shady canopy with plenty of air-flow. Many more complex tents take inspiration from the common basis of the dome.

Variety of Dome tent forms.



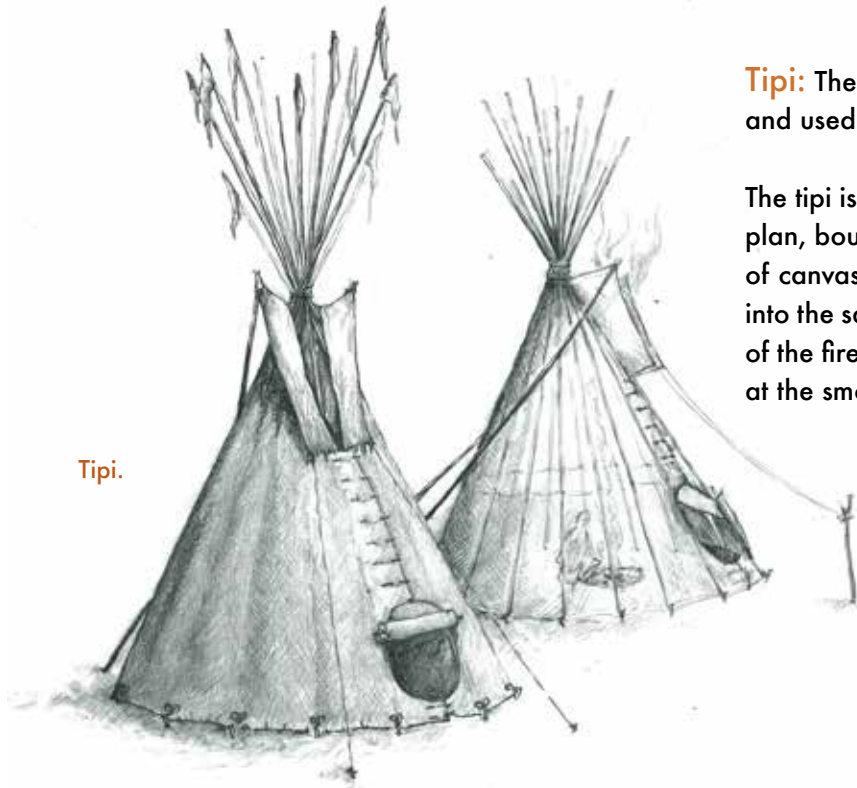
**Yurt:** The Mongolian yurt (also known as *ger*, or as *úy* by its Turkic users, translated in all cases as 'home' or 'dwelling') has been used on the central Asian steppes for thousands of years, and was introduced widely across cultures as far as Turkey by the conquest of Genghis Khan.

Turkic and Mongolian Yurts.



The yurt is a cylindrical tent, topped with a shallow conical roof - traditionally wrapped in felted wool, now in canvas. Yurts are characterised by the use of a circumferential tension-band, which contains the roof's outward thrust and allows the walls to be lightweight retractable trellis (supporting only the gravity weight of the roof, and not lateral forces). A central fire lets its smoke out an opening in the apex of the roof, where the rafters meet at a 'hub' ring. Functions are divided into quarters around the fireplace, with the most sacred at the back.

## [ FORMS OF THE TENT ]



Tipi.

**Tipi:** The tipi (also spelled *teepee* and *tepee*, translated as 'used for living in') is the iconic tent developed and used by the North American Indians.

The tipi is constructed as the shape of a cone by tall, slender poles that lean inwards from a circular ground plan, bound together partway up their height by a rope. A cover - traditionally made of buffalo hides, now of canvas - is pinned together up the front with wooden dowels, incorporating a doorway and smoke exit into the same join. The tipi is made around a central fire, which internal layout circulates around. Ventilation of the fire is controlled by an inner head-height curtain that lessens ground-level drafts, and directional flaps at the smoke exit opening.



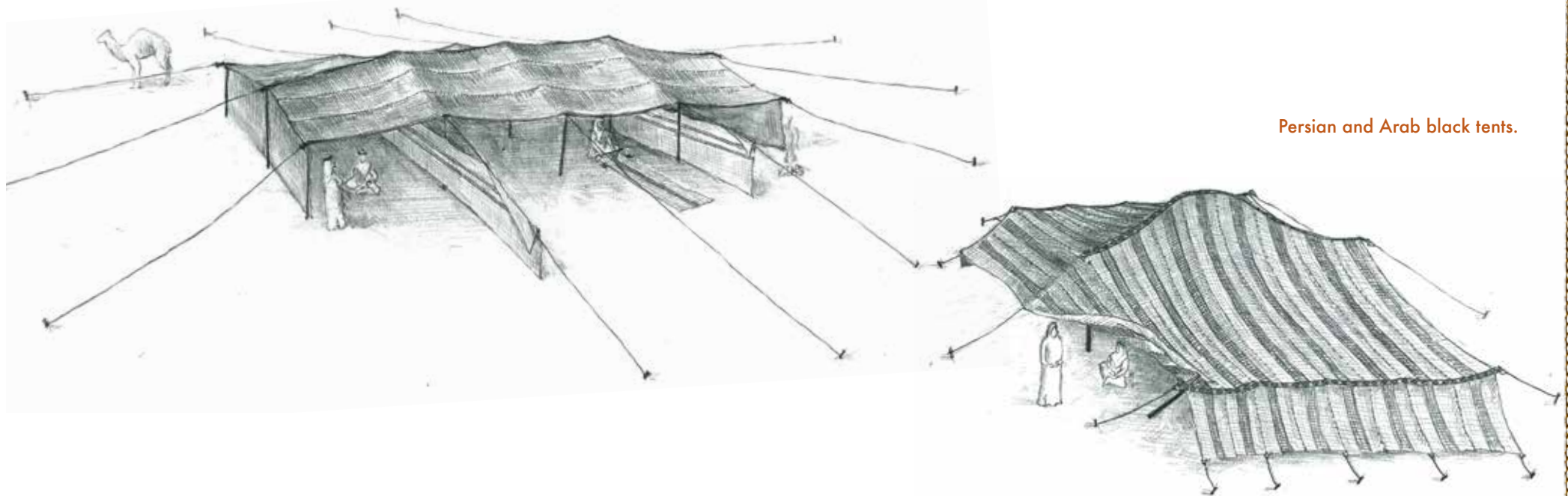
Ridge tent.

**Ridge tent:** The ridge tent, in its most basic form, consists of two upright poles with a cable tied between and a cover hung over and pegged out, to create a wedge shape. This type of tent was used widely by the Inuits, who built a variety of forms which they covered with seal skin. Most ridge tents were small in size, intended for the purpose of sleeping, rather than cooking or other daily activities - which the Inuits had larger dome and yurt-like tents for.



**Black tent:** The term 'black tent' refers to a variety of Saharan desert tents, common by the use of a woven cover of black goat's hair.

Black tents are incredibly lightweight; constructed of just a few poles or hoops, and a cover that is draped over them and held out with guy-lines. This tent is highly changeable, adapted from season to season, from tribe to tribe, or as function requires. There are two basic structural types of black tent. In the *Persian* form the direction of stretch is along the woven lengths of cloth, whereas in the *Arab* form the stretch is across the cloth, tension resisted by bands sewn on. Internal space is divided by curtain walls, and as the climate is hot the fire is often placed outside.



Persian and Arab black tents.

## [ FORMS OF THE TENT ]

**Pavilion tent:** The pavilion tent is a medieval tent, developed by armies as a repeatable shelter taken on campaign. Based on a square plan with central and corner supports that the skin is stretched out from, this tent was favoured for its straight upright walls that fit conventional furniture. However, the flat walls flap easily in the wind, not being as strong as a curved tensile surface.



**Turret tent:** The turret tent is also from medieval times, when it was used as kind of marquee. The turret tent is a large tent that has a range of different forms based on conical turrets and ridges that join them together. The turret tent is associated with regal festivities and was often lavishly decorated in rich fabrics.

## Present tents

**Bell tent:** The bell tent is a cone shape with walls, supported by a single central internal pole, the skin pulled out by radial guy-lines - often around 5 meters in diameter. This tent was used by the British army around W.W.1., as a lightweight and transportable camp. As many of the following tents also do, the bell tent uses an outer 'fly' layer that sheds water and insulates.



**Rectangular frame tent:** The rectangular frame tent uses bent metal poles that fit into a casing sewn in the tent's skin to create a braced support. This is similar in form to the pavilion tent, but without the obstructing central pole. This tent is currently used by both armies and campers.

## [ FORMS OF THE TENT ]

**Camping tent:** The camping tent is designed to provide sleeping shelter, which is easily carried, for backpacking hikers. For this reason minimised weight is a key driver of design.

The camping tent has had two different and distinct forms. Earlier camping tents were based on the ridge tent and were rectangular in plan, whereas many newer designs are based on the rounded forms of dome construction. The unique aspect developed in domed camping tent is that the skin is pulled tight, resisting the hoop's tendency to spread outwards - unlike the traditional dome, where the skin was simply wrapped and the hoops needed to be secured to the ground to restrain their outward thrust.



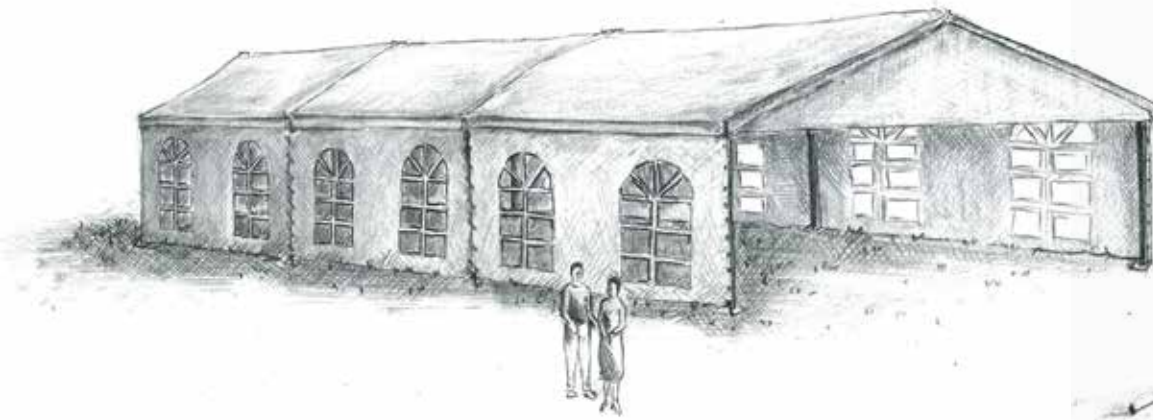
Camping tent, ridge (or wall) and dome forms.



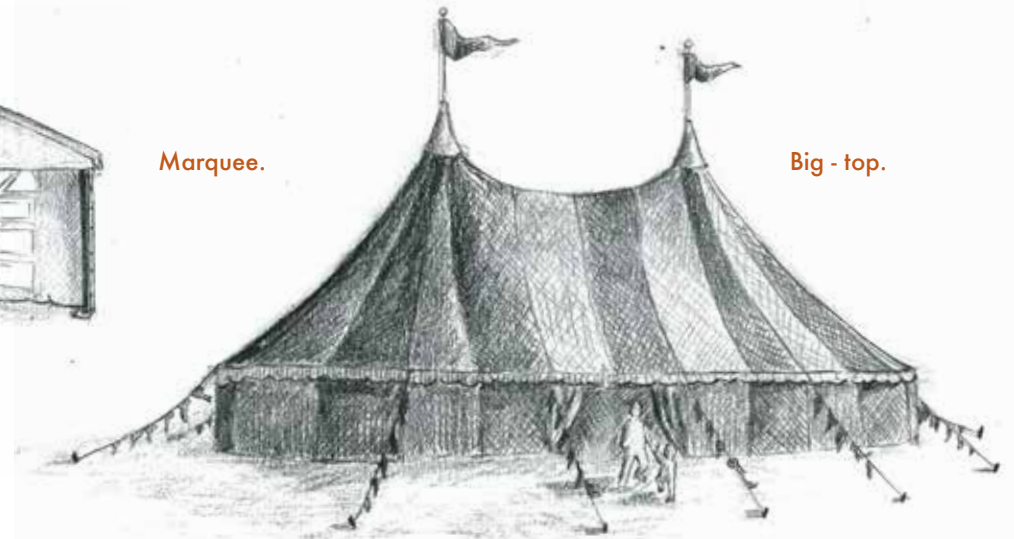
Disaster relief Tunnel tent.

**Disaster relief tent:** There are a range of designs for temporary disaster relief shelter, many of which are based on military or camping tent designs. Cost efficiency as well as minimum packaged size is a key driver in their design. One common form is the tunnel tent - a variation on the dome tent.

**Marquee:** The marquee is a large-spanning tent that caters for a range of different functions, often of a celebratory nature. Because of the changing events that it provides for, the marquee is designed as a non-specific shell of shelter, efficient to be erected quickly. Many modern marquees are designed similarly to rectangular framed tents, but at a larger scale, and with the canvas fitting as panels into a free-standing framework.



Marquee.



Big - top.

**Big-top:** The big-top is the iconic form of the circus tent, and is related to the marquee in function, but is often more festively decorated.

This tent is supported by central upright poles which the canvas skin is pulled out from by guy-lines, creating a double peaked oval form in plan. The minimal supporting structure makes transportation of this tent easier, and may be seen as a development of the form of the turret tent.



## STRUCTURE OF THE TENT

Most tents are simple geometric shapes; cones, cylinders and domes with central and symmetrical openings. The common form of most tents is based on a circular plan, the curve being an inherent feature of tensile construction. The circle provides stability, it minimises surface area and negates corners, thus reducing weight and complexity. In their roundedness, tents are distinct from the square angles of compression structures, and present a very different spatial atmosphere.

The tensile strength of any given material is a measure of its ability to withstand a stretching force without tearing apart, and the availability of materials with high tensile strength has determined the forms of traditional tents and revolutionised the field of modern tensile engineering. Tensile strength defines the structural reliance on either skins, on ropes or on supporting frameworks - as it is one thing to find or make a skin, but it is another to have a skin that is sufficiently strong not to rip. This structural truth is realised in the differences between the *yurt* and the *black tent*. In the first, the skin is *wrapped*, and in the second the skin is *stretched*. In the first it has *low* tensile strength and is used as a cladding, and in the second it has *high* tensile strength and fulfils a structural role. To distinguish the difference between these two forms to tents, I shall respectively define their forms as '*frame tents*' and '*skin tents*'.



[ Just being wrapped in a skin does not make a tent. The artist Christo encloses large objects in fabric, such as *Wrapped Reichstag* (Berlin, 1995). However, revealed underneath the soft fabric cover there is still heavy solidity. ]

*'They might be made even more engaging if the underlying structure can be made to move around.'*  
- Christo <sup>5</sup>

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5. Quoted in: Siegal, Jennifer. *Mobile: The art of portable architecture*. New York: Princeton Architectural Press, 2008: p. 7.

## The frame tent

In cases where materials with high tensile strength are not available we find the *frame tent*. This is the yurt and the tipi, and it is also some forms of the modern marquee. The yurt was traditionally covered in felted sheep's wool, and the tipi in raw-hide buffalo skins, however both of these materials will deform and rip if stretched. To deal with this weakness, these tents were designed with free-standing frameworks, which the covers were then wrapped around. The skin was primarily a handy packagable cladding, favoured for its thinness and flexibility. Tensile principals were then used to minimise the supporting framework, steadied with guy-lines, containment bands and lattice construction.



## The skin tent

The *skin tent* is the most lightweight form of tent, and perhaps we could even call it the most 'tent-like' because it is the most truly tensile structure. The skin tent was created where materials with high tensile strength were known how to be made, and is now the principle behind almost all modern tent design. The original skin tent was the desert black tent, which used a woven fabric; the warp and weft threads providing tensile strength. In the skin tent, the tear-resistance of the skin allows it to be stretched over wide distances between uprights in a way that the skin steadies the posts or hoops that hold it. The skin and the props that hold it aloft work *interdependently* together - neither would stand without the other. This is true symbiosis that allows the greater efficiency that skin can act simultaneously as both structure and as cladding.



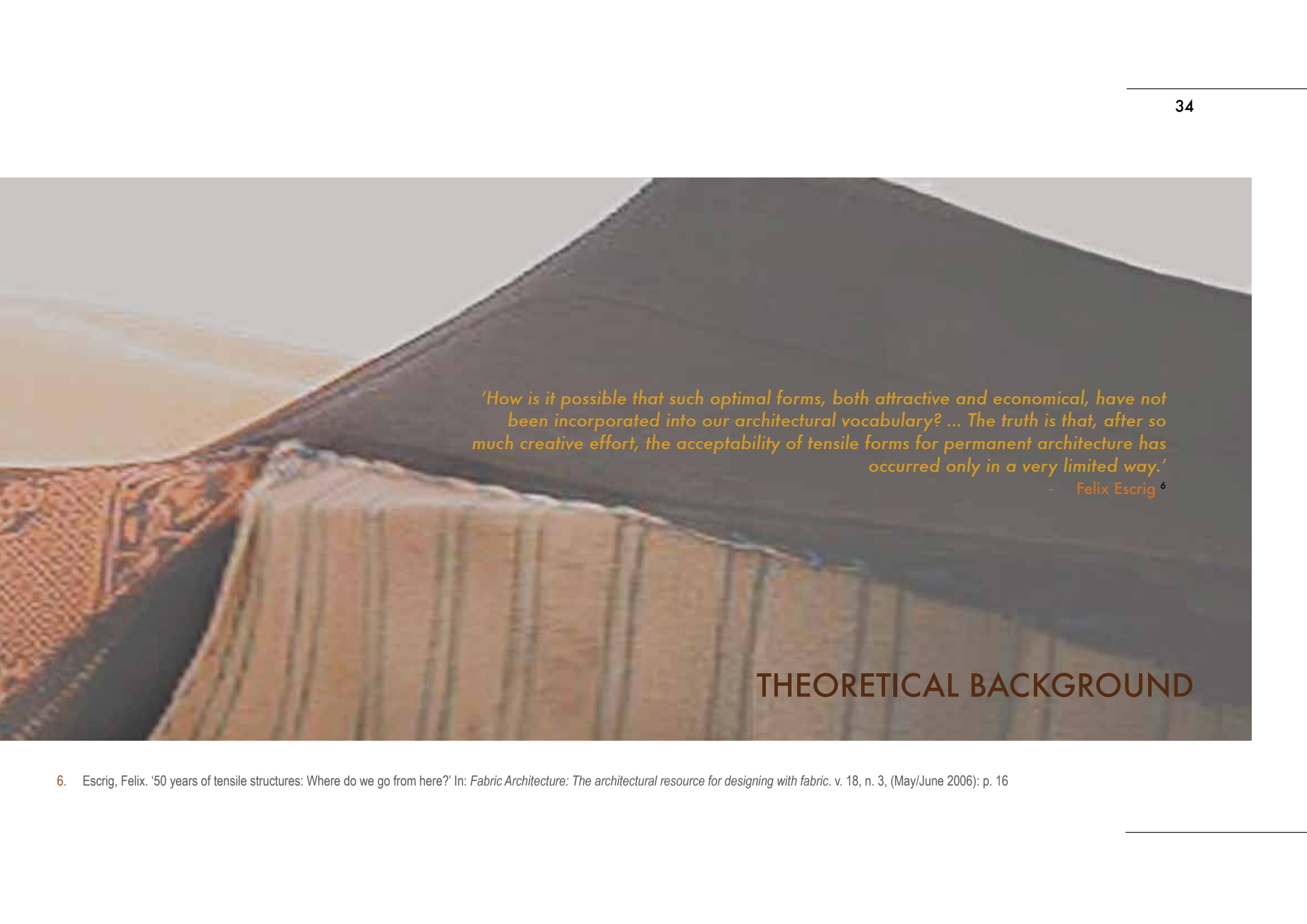
**DESIGN:** Recognition of these two distinct forms of tents is of relevance to the design aspect of this thesis. The skin tent, as the most tensile, and as the type that could not be made out of any other material other than a skin membrane, highlights behaviour specific to the nature of tent construction and brings focus to the nature of fabric beyond its ability to simply be flexible and to wrap.



Desert 'Black tents'.

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*'How is it possible that such optimal forms, both attractive and economical, have not been incorporated into our architectural vocabulary? ... The truth is that, after so much creative effort, the acceptability of tensile forms for permanent architecture has occurred only in a very limited way.'*

- Felix Escrig <sup>6</sup>

## THEORETICAL BACKGROUND

6. Escrig, Felix. '50 years of tensile structures: Where do we go from here?' In: *Fabric Architecture: The architectural resource for designing with fabric*. v. 18, n. 3, (May/June 2006): p. 16

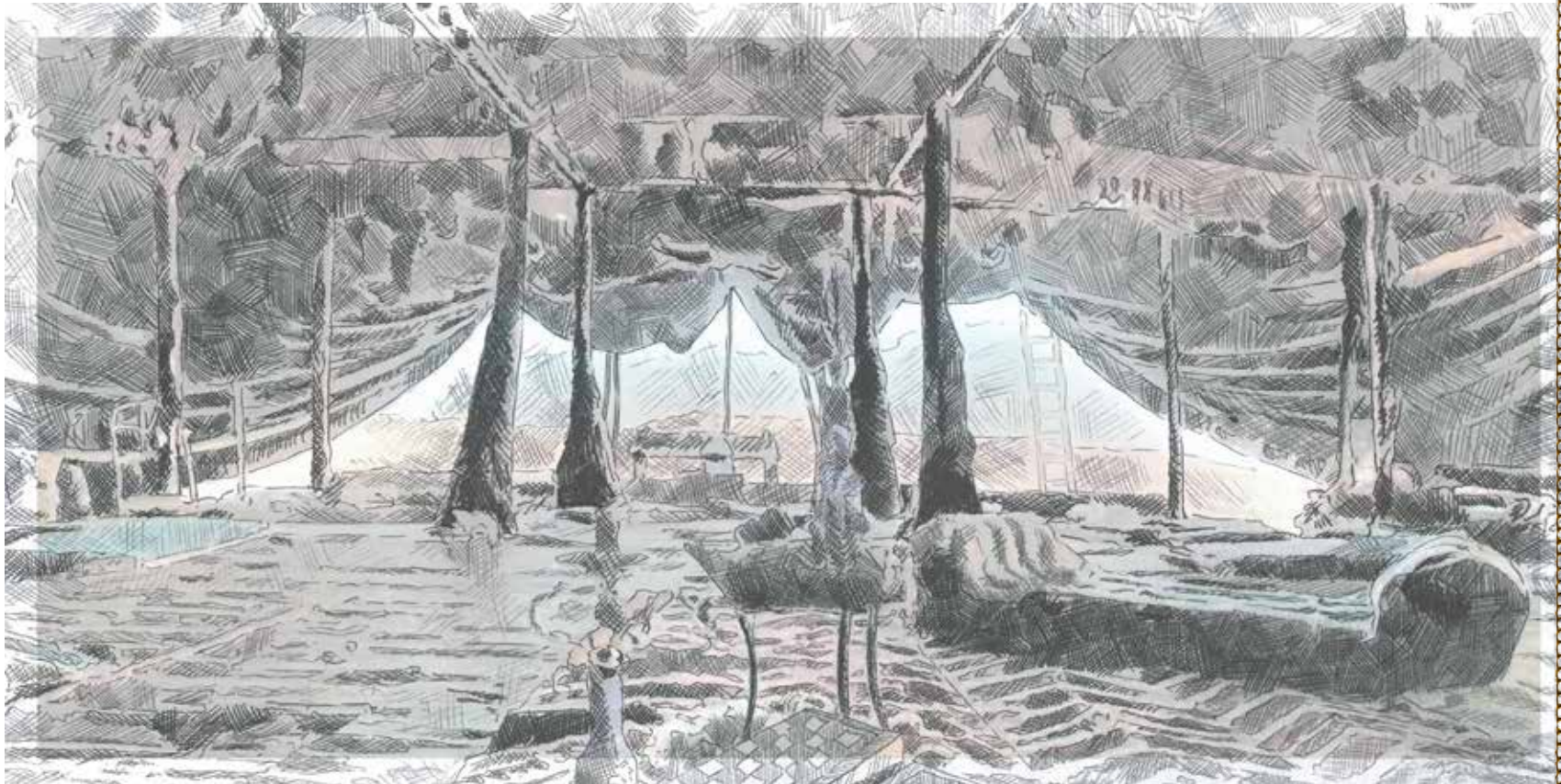
## THE CHANGING FUNCTION OF THE TENT

The tent was originally designed for use as a home, intended for sheltering the daily activities of eating, sleeping and family life. This original functional use is true for tents of all origins alike, being initially developed to fit the requirements of a nomadic lifestyle. The need for mobility created the lightest-weight and most easily transportable forms, and generations of daily use thereafter refined their construction to meet further needs of security, comfort and social meaning. It may be seen that only through such perpetual daily and inter-generational inhabitation was the tent able to achieve such forms of clear refinement.

However, along the course of the tent's development, its use changed. As nomadic people settled into sedentary lifestyles, transportable shelters were no longer needed, and the tent - ever the example of adaptability - rather than being lost, began to serve a new function. It was the practical attribute of minimum material creating large space that ensured its survival. The tent's founding use as a home was replaced by the function of a deployable shelter for short-term events, shifting it from daily use to temporary use. But as the tent's function changed, it also changed the tent.

While the tent was always designed with practical requirements at the fore-front, as a home it had also engaged with more intimate human sensibilities. The tent as a home had included a personalised layer of construction that gave it a richness of beauty, comfort and meaning. However this was stripped when its use changed; its new use privileging a focus on *function* rather than *occupation*, and on *edifice* rather than *occupant*. The efficient aspects of its construction were favoured, and so as the tent continued to develop it became even lighter, but it also lost much of its textural meaning.

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Interior of a traditional desert tent.

## THE ARCHITECTURAL STATUS OF THE TENT

Tents are now so governed by construction efficiency that the question is raised if they are even architecture at all - or if they are just purely engineering<sup>7</sup>. We may use the term 'built fabric' to refer to the constructions of our society, but rarely is the tent ever included as part of this definition.

There are many assumptions about architecture. Architecture typically has enduring monumentality; it is constructed of solid materials and is of an imposing scale. Architecture is often non-domestic in function and it possesses a rich body of emotive meaning as intended by a creator<sup>8</sup>. However, the tent fits none of these descriptions. Instead it comes from a tradition of vernacular construction<sup>9</sup>, and has been the domain of industrial designers and engineers since. The tent speaks the language of impermanence, it is repeatable, and its contemporary manufacture has given it a connotation of cheapness and disposability<sup>10</sup>. Coupled with a common perception that tents generally lack the provisions of comfort, the tent has a hard time fitting our architectural expectations.

Let's investigate how the tent relates to architecture by looking at two architectural theorists; Marcus Vitruvius and Gottfried Semper.

7. Berger, Horst. 'Tent structures: Are they architecture?' In: *Architectural Record* (May 1980): p. 127-134. This article states that, by common conception, tensile structures are merely feats of engineering. While the article goes on to defend the architectural aesthetic of the forms created by tensile structure, it also makes no mention of any construction less monolithic than a stadium; revealing the truly unconsidered status of the real tent.
8. These definitions come from: Rybczynski, Witold. *The most beautiful house in the world*. USA: Viking Penguin, 1989. [This author becomes an important source for understanding the quality that makes a shelter feel 'homely' later in this thesis.]
9. The debate between 'vernacular construction' and 'architecture' is outside the scope of this thesis. For an in-depth discussion see: Rudofsky, Bernard. *Architecture without architects: A short introduction to non-pedigreed architecture*. London: Academy Editions, 1964. Or also see: Oliver, Paul. *Shelter and society*. London: Barrie & Jenkins, 1969.
10. Escrig, Felix. '50 years of tensile structures: Where do we go from here?' In: *Fabric Architecture: The architectural resource for designing with fabric*. v. 18, n. 3 (May/June 2006): p. 16.





Interior of a modern marquee.

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[ THE ARCHITECTURAL STATUS OF THE TENT ]

## Marcus Vitruvius

Marcus Vitruvius, 1<sup>st</sup> century BC Roman writer and engineer, wrote in his treatise - 'De architectura' / 'Ten books on architecture' - that true architecture has three virtues; *strength, usefulness and beauty*<sup>11</sup>. To be true architecture, Vitruvius saw that a building must achieve all of these virtues concurrently. In these terms we find a measure to understand the tent's architectural status, and also to recognise where it may not meet expectations.

*'All these should possess strength, utility, and beauty. Strength arises from carrying down the foundations to a good solid bottom, and from making a proper choice of materials without parsimony. Utility arises from a judicious distribution of the parts, so that their purposes be duly answered, and that each have its proper situation. Beauty is produced by the pleasing appearance and good taste of the whole, and by the dimensions of all the parts being duly proportioned to each other.'*

- Marcus Vitruvius<sup>12</sup>



Classical Greek columns.

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11. These three terms have also been translated as *firmness, commodity and delight* (by Henry Wotton in *The Elements of Architecture*, written 1624).

12. Vitruvius, *De architectura*, book one, chapter three, verse two. Translation from: [http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Vitruvius/1\\*.html](http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Vitruvius/1*.html) (accessed on: 25/3/2011).

'*Strength*' initially raises associations of unrelenting mass, and is not a commonly considered characteristic the tent. However, by the term 'strength', Vitruvius did not necessarily refer to solidity, but instead to the simple fact of achieving structural stability and of choosing appropriate construction materials. While the tent does not possess the strength that comes with literal rigidity, it still has qualities that fit Vitruvius's description. It has strength in the resilience that it achieves through flexibility, and is durable by its ability to respond to change, to meet diverse uses, and to be made and remade again. By realising a more general view of strength, the tent is indeed strong.

'*Usefulness*' asks of the ease by which a building meets its intended function, and in many ways 'usefulness' is integral to the tent. It is the factor that created the first nomad tents, by responding to the needs of a mobile lifestyle, and it is the quality favoured and advanced in the modern tent, as an easy kit-set shelter that caters for a variety of different functions. However, while 'usefulness' defines an architectural aspect of the tent, in the present day it has become the predominant design focus, and this means that this quality has grown it out of balance with Vitruvius's two other architectural virtues. The tent is indeed useful, but to modern design it is treated as *only* useful.

'*Beauty*' describes the pleasurable experience that a building impresses when all of its parts are harmoniously balanced, and in the tent there is often a clear expression of form and volume which is balanced by the finer scales of the details of its construction. However, in the modern tent, efficiency has pared back materials to smooth and featureless surfaces, and where once the tent embodied the texture and beauty of fabric construction, its form has now become stark in comparison. The modern tent is a form without texture, an empty shell of space that is difficult to engage with. By removing the softer details of that made sense of the overall form, the tent and has lost its ability to inspire delight.

While the tent has the ability to fit all three of Vitruvius's architectural virtues of *strength*, *usefulness* and *beauty*, in its modern form, design has focused so closely on factors of its 'usefulness', that aspects of its 'beauty' have been sacrificed. Where the tent may once have satisfied Vitruvius's definition of architecture, it has now lost balanced realisation of his three defining features thereof.



## [ THE ARCHITECTURAL STATUS OF THE TENT ]

## Gottfried Semper

Gottfried Semper (1803-1879), German architect and art critic, wrote about the origins of architecture. In his book - *'The four elements of architecture'* (written in 1851) - Semper describes that basic material construction processes developed very early in history, and that they still contribute meaning to the way that we build today. The processes he identified were the making of the *hearth*, the *roof*, the *enclosure* and the *mound*. These are the 'four elements of architecture', respectively related to the materials of fire, wood, textiles and stone. 'Enclosure' is of special relevance to this thesis, relating directly to textile construction and describing it as having a founding place within architecture.

*'... the use of mats and carpets for floor coverings and protection against the heat and cold and for subdividing spaces within a dwelling, in most cases preceded by far the masonry wall... [Later,] Hanging carpets remained the true walls, the visible boundaries of space. The often solid walls behind them were necessary for reasons that had nothing to do with the creation of space; they were needed for security, for supporting a load, for their permanence and so on. Where ever the need for these secondary functions did not arise, the carpets remained the original means of separating space.'*

- Gottfried Semper<sup>13</sup>



Woven carpet textile.

13. Semper, Gottfried. 'The four elements of architecture' In: *The four elements of architecture and other writings* (edited by Francesco Pellizzi), p. 74 – 129. New York: Cambridge University Press, 1989: p. 103 – 104. In a later chapter in this book, Semper describes many ancient techniques of weaving and working with fibres. This is interesting but beyond scope of this thesis.



Semper believed that in ancient shelters, textile mats were the original means used to create spatial separation, exclusion and inclusion, and that only later when the structural requirements of transferring loads and of creating impenetrable security were needed, did walls gain mass. He hypothesised that, as solid walls were developed, they did not replace the use of fabric but were instead treated as secondary and hidden behind a layer of hanging tapestries. Through this Semper describes that hung fabric, rather than being a non-architectural and decorative afterthought, is actually more primary than solid construction, and that although we may have forgotten this<sup>14</sup>, contemporary architecture still contains a residual meaning and symbolic value that comes directly from woven textiles.

As this relates to the tent, Semper's theory describes fabric's ancient value in the creation of the first types of enclosure, and of the underlying importance that this has had on the development of architecture. The tent may thus be seen to exist as a continuance of founding architectural values, which - further than as mere reference to the past - shows a current day manifestation of qualities that are common with the original fabric shelters. However, in searching for the architectural aspects that permeate from Semper's fabric enclosures into the form of the modern tent, we are reminded of the stream-lining that the tent has undergone, and once more see that those fabric details which are closest to its architectural nature have been removed in the pursuit of efficiency. Where Semper's fabric enclosure contained space within the folds of softness and texture, the modern tent contains space within homogenous flat planes. So while fabric construction contains a historic memory and a vocabulary of expressive qualities which relate directly to architectural concerns, we also see that the modern development of the tent has stripped these.

Semper's theory positively defines the architectural status of the tent, placing it at the very origins of both methods of construction and of social meaning - doing so through an appreciation for the expression of its fabric nature. However, by removing even the texture of fabric's weave from the modern tent, so too its architectural virtues have been lost.

14. 'Boorstin's law' states that solid construction gains a disproportionate importance by its ability to endure for longer than more delicate constructions.

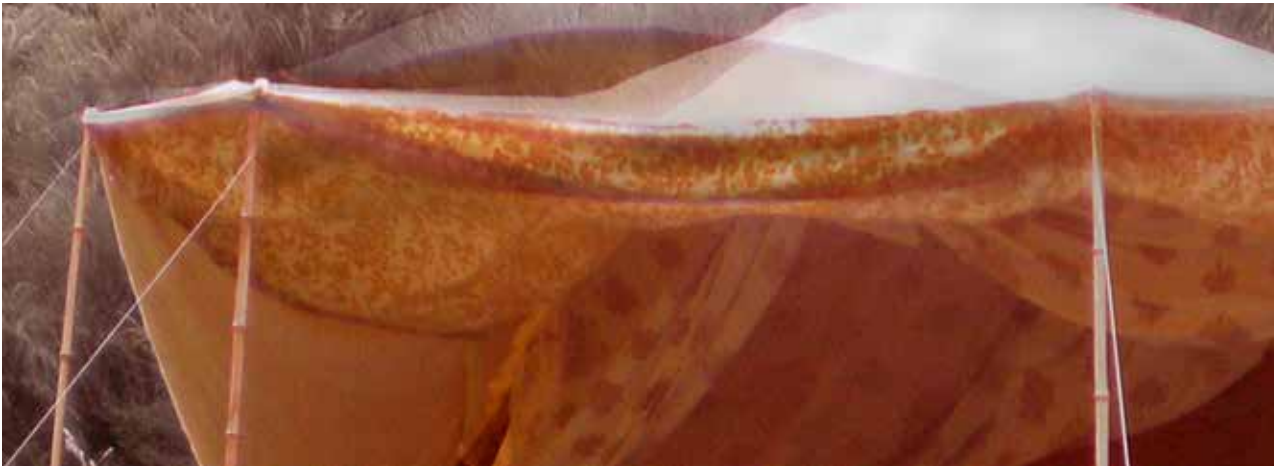
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[ THE ARCHITECTURAL STATUS OF THE TENT ]

## Conclusions

The tent is changed from the form that it once was. Once it was intimately known - used daily as a family home - but now it has been stream-lined by efficiency to become an impersonal shell of shelter. The focus of its design has changed, and in doing so it has lost its expression that made it a candidate for architectural recognition.

The tent stands on a perilous edge, questionably walking the line around that which defines architecture. A comparison of the tent to Vitruvius's three architectural criteria of *strength*, *usefulness* and *beauty* reveals that, while the tent may indeed satisfy all of these qualities, in its modern design the quest to optimise its usefulness has led to the loss of details of its beauty. This non-architectural fate of the modern tent is echoed through Semper's textile origins of architecture, where the spatial qualities of fabric enclosure are validated as indeed 'architectural' and said to permeate into the meaning of contemporary construction, however have not been continued in modern tent design - once again stripped by a focus on efficiency.



Design image.

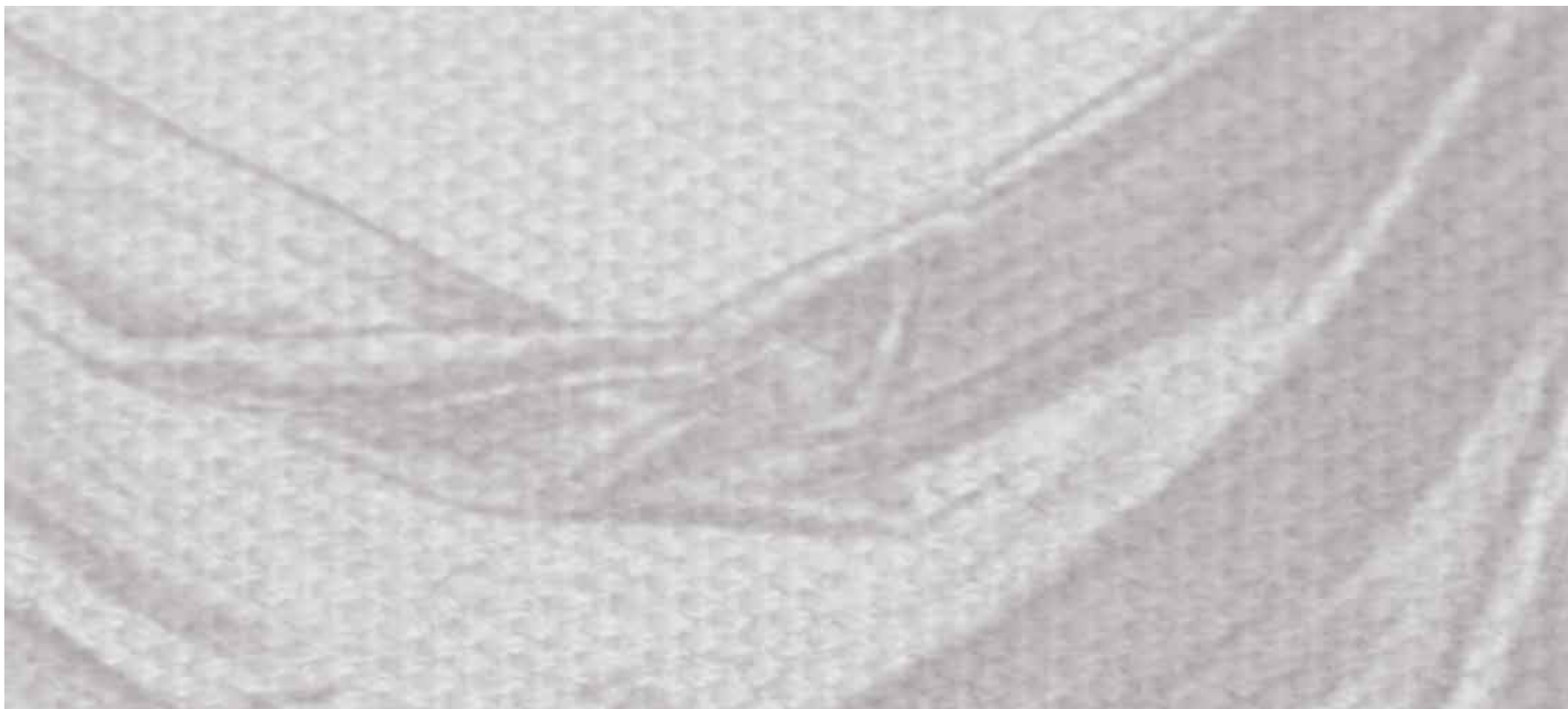
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The architectural aspects of fabric construction that we may elucidate from both Vitruvius and Semper's theories are those unique qualities of permeability, softness and of woven texture. So while our view of the tent may be understandably non-architectural, this is not because the tent is outright unworthy of recognition, but instead because that in its recent development the expression of fabric texture has been removed and duly forgotten. While Vitruvius offers a clarification that for architectural recognition functional factors of 'usefulness' must be balanced against consideration for their aesthetic appreciation, Semper gives a more anthropological view that reminds us of fabric's place in the first primal shelters, and of its personal meaning persisting through history. From Vitruvius we may take a description of the potential beauty which comes from a balanced whole and a realisation of the texture of fabric construction, and from Semper we may remember the meaning that is ingrained from centuries of use.

Would either of these two men agree that the tent can be architecture? It's doubtful<sup>15</sup>. But we must remember that times have changed, and so has the tent - and still it has the potential to change again. In fact, it is precisely the changeability and shifting function of the tent that leads it to eluding architectural recognition, but that conversely has the potential to allow it to be 'architecture' also. If Vitruvius says that architectural status is related to ability to provide beautifully for usage, then by reclaiming the texture of fabric construction and providing comfort for the user the tent may become architecture once more. And by considering Semper's view, that architecture relates to the personal meanings relayed through time, the tent yet stands on grounds that are within the realm of architectural realisation.


The architectural potential of the tent comes from an instinct that sparked this thesis - the sense that tents do indeed have such. The tent has a spatial atmosphere unlike any other form of construction; its curvaceous structure contrasts conventional rectilinear forms, it has a palpable sense of movement and light-weightedness, and it has a potential for tactile beauty inherent in the fabric of its construction. All of these qualities relate directly to architectural concerns, and await recognition and development. By redefining the tent, that is what this thesis aims to do.

15. Semper didn't even approve of Joseph Paxton's lightweight glass and iron *Crystal Palace*, as stated in: [http://www.encyclopedia.com/topic/Gottfried\\_Semper.aspx](http://www.encyclopedia.com/topic/Gottfried_Semper.aspx) (accessed on: 1/4/2011).



Fabric texture.

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*'Everything flows, nothing stands still ... Nothing is permanent except change.'*  
- Heraclitus<sup>16</sup>

## RESEARCH EXPLORATION

<sup>16</sup>. As quoted by Plato in *Cratylus*

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## THE INFLUENCE OF THE TENT

The tent is an ancient form of construction, and has had centuries in which to influence other areas. It is a structure that has a range of practical and poetic virtues, and has provided stimulus - both directly and indirectly - for development in many fields. Both prefabrication and modular construction have benefited from lessons taken from the tent. And, while it may sit outside conventional architectural acceptance, architecture has also gained much from reference to it. Although recognition of aspects influenced by the tent are sometimes not initially obvious, having been transformed in the process of adaptation, they are still identifiable for their uniqueness among construction methods.

This study of the influence of the tent covers many different fields. However, only an overview of each area is made here, as this section would otherwise fill disproportionate space within the thesis. Although brief, this is a useful study to remind us of the diverse range of qualities that the tent holds.

### Structure

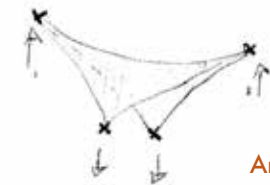
The field of tensile engineering owes a great deal to the structure of traditional tents, especially to the black tent.

Tensile engineering privileges the exceptional ability of stretched surfaces to span large distances without intermediate supporting structure, and the development of steel - a material with high tensile strength - was a cue for realising spans longer than ever before created. Vladimir Shuckhov, tensile pioneer, built the *Oval pavilion* (Nizhny Novgorod, 1896), as a founding example of this whole area of engineering (1.).

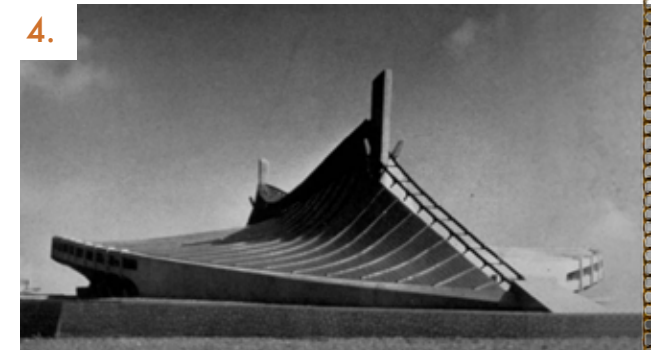
Frei Otto is well known for his use of tensile engineering. Otto came from a family tradition of tent making - his father a tent maker - and this knowledge was coupled with contemporary developments in new materials to create tensile structures on a large scale. Otto's contribution to the field was recognition of the *anticlastic curve* - two opposing curves in the shape of a saddle that make a flexible surface evenly taunt. He used this structural form to create simple yet beautiful canopies, such as his *Music pavilion* (1955) (2.), and more complex forms such as the *German pavilion* for the Montreal World Expo (1967) (3.)<sup>17</sup>.

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17. The word 'pavilion' comes from french, where it was initially used to refer to anything likened to a *tent*.



Anticlastic curve.



While many applications of tensile engineering are for temporary use, such as in the examples just given, many more examples are of unmovable constructions which deviate from the tent. The field of tensile engineering uses the influence of the tent predominantly for virtues of its long-spanning ability. These examples are the stadium and arena roofs of David Geiger, Kenzo Tange (4.) and Eero Saarinen. These constructions differ from tents in that they completely replace the use of fabric with the use of steel instead.

## [ THE INFLUENCE OF THE TENT ]

## Construction

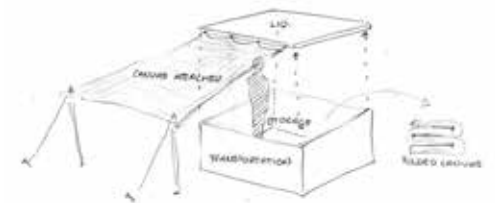
Tents have influenced construction methods through the unique way in which they deal with issues of assembly, manufacture, and changing function. This sees aspects of the tent present in approaches to prefabrication, modulation and transportable and adaptable structures.

Architect Buckminster Fuller is quoted famously as asking, “*Madame, how much does your house weigh?*” Like the tent, Fuller aimed for lightweight and simplified construction methods, and came to prefabrication and modulation to achieve this. In the 1920’s and 1940’s Fuller designed two versions of the *Dymaxion house*, a mass produced home made from factory manufactured components (5.). *Dymaxion house* presents direct similarities to the appearance of the yurt, and matches the modulation of its construction - however with a different system. Fuller also used geodesic lattices to create dome shaped frameworks, such as the ‘*Biosphere*’ pavilion (Montreal, 1967) (6.).

5.



6.





Architect Shigeru Ban has also been influenced by the tent. A number of his projects use repeating modular systems, such as the *Japan pavilion* that he designed (with Frei Otto) for the Osaka World Expo, in 2000 (9.)<sup>18</sup>. He uses tensile structural systems to minimise materials such as in *Takatori Catholic Church* (Kobe, 2005) (7.). And in *Curtain wall house* (Tokyo, 1995), he uses a drop of fabric to create an exterior wall (8.). Although Ban uses many construction techniques inherent to the tent - and has also designed *real* tent disaster relief shelters - the examples mentioned here, like the previous ones, deviate from actually being tents.

#### Design question 1: HOW TO PACKAGE A TENT?

Considerations of how to transport a tent began an idea of a box for all parts to fit in which could also become a structural core when the tent was erected. This box would contain all electrical and plumbing services, ready to be plugged into, however I dropped this idea when I realised that the rigid and flat faced box contrasted with the soft flexibility of the tent - and why not just use a bag to transport?

18. It is interesting to note the common thread that Otto, Fuller and Ban knew or worked with each other, and that they all designed 'pavilions'.

## [ THE INFLUENCE OF THE TENT ]

## Form/Space

The tent has been used widely in architecture as a metaphor of open flowing space and curved form. While these simple qualities indeed extend beyond the influence of the tent<sup>19</sup>, there are architects who look specifically to the tent for inspiration. The projects of these architects embody a spatial quality similar to the tent, and use forms and materials evocative of its construction.

The architecture of Glenn Murcutt has a great deal in common with the spatial quality and the form of the tent. In *Magney house* (New South Wales, 1982 – 84) Murcutt uses a billowing curve of sheet steel in a way that captures the slenderness and movement of fabric (10.), and in many of his designs he considers how spaces flow into each other and into the landscape with greater than usual openness. While Murcutt was also influenced by Modernism and the simplicity of *Farnsworth house*<sup>20</sup> (designed by Mies Van der Rohe in Illinois, 1946 – 51), he states himself that he is directly influenced by the tent.

10.



*'I have a great desire to build a building that is almost a tent-like building.'*

- Glenn Murcutt <sup>21</sup>

19. Such as the consideration of just the flow and form of fabric to create curvaceous structure and layouts (For more see: Hodge, Brooke, Patricia Mears, & Susan Sidlauskas (Eds.). *Skin + bones: Parallel practices in fashion and architecture*. Italy: Thames & Hudson, 2006.). Indirectly, Minimalism also has links to the weightless spatial quality of tents, and some later works of Modernism mimic rounded tent-like volumes of space. An unintentional reference to the spatial quality of the tent can even be found in the Japanese house; the washi-paper walls permeable in a manner similar to fabric, and movable to create flowing space. (Perhaps due to the Japanese house we may understand why Japanese architect Shigeru Ban, - mentioned on the previous pages - draws inspiration from the tent.)

20. Murcutt was introduced to this house as a first artefact of architecture at a young age. Stated in: Drew, Philip. *Touch this earth lightly: Glenn Murcutt in his own words*. Sydney: Duffy & Snellgrove, 1999: p. 67.

21. Ibid. p.155



11.



12.



13.



Perhaps reference to the tent comes as a result of a parallel response to an arid climate, similar to that in which many traditional forms of tents developed. Cox Richardson and Gabriel Poole, both Australian architects, refer to the tent and use real fabric to create roofs, casting sheltering shade. In *Longitude 131* (Uluru, 2002) Richardson uses stretched fabric to form a canopy similar to a tent fly (11.). And *Tent house* (Eumundi, 1990) is just one example designed by Poole where fabric is used to shelter the structure (12.). Frohn and Rojas also use stretched fabric, such as in *Wall house* (Santiago, 2004 – 07), to clothe and to extend space (13.).

However, in the example of these four architects a theme emerges. Reference to the spatial openness and connection to the landscape of the tent has opened up the walls and given a new hat or coat to their designs, but still underneath the rectangular form of conventional construction lurks. And while their materials may reference movement, they are still rendered solid. The metaphor of the tent has provided inspiration, but it has still been given weight and resistance so that it satisfies Vitruvian ideals of unrelenting strength. Furthermore, the way that some of these buildings float above the ground is dissimilar with the nature of the tent. In 'touching the earth lightly' the designs have been raised off the ground by stilts<sup>22</sup>, and this is very different when compared to the tent which sits directly on the ground - connected and even pinned to it, the ground moving between inside and outside with no step in transition. Thus these examples show the compromises made in recreating tented forms in solidity.

22. Due recognition that this approach is a practical one, for keeping bugs, snakes and flood waters out of the house.

## [ THE INFLUENCE OF THE TENT ]

## Symbol

The tent has been used as a symbol since biblical times, when it was seen as representing heaven. In cathedral ceilings, castle turrets and monuments, the form of tent was used; represented in its curved, peaked shape, and in layout - however, rendered in solid stone masonry (14.). Philip Drew called this the 'petrification of the tent'<sup>23</sup>, and describes that the tent was understood to embody the meaning of a universal sky of the tabernacle of heaven's reception - referencing something godly and ephemeral, yet rendered solid in the quest for the permanence of eternity<sup>24</sup>.

*'The parasol-roofed tent was identified with the idea of heaven as long ago as the ancient Persians, when it served as the tent of reception.'*

- Book the first 29 : 4 <sup>25</sup>

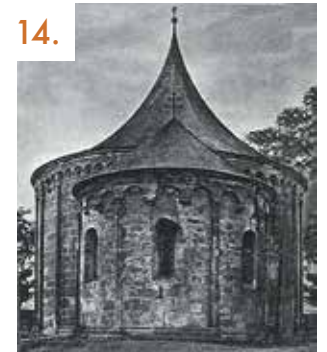
*'The sky is an immortal Tent built by the sons of los.'*

- Book of Isaiah <sup>26</sup>

Drew also suggests that the tent is essentially feminine through reference to its soft form. This has an interesting connection to the fact that it was traditionally the woman's domain; owned, erected and thus designed by women across most cultures<sup>27</sup>.

The tent was a popular motif in France and Germany in the 1800's, where it was used to reference the success of great military commanders, such as Napoleon, and the tents that were used during their campaigns. Fabric was draped from walls, filling entire rooms in flowing folds, such as the bedroom of Empress Josephine at *Chateau de Malmasion* (decorated 1810) (15.). This shifts the symbolic use of the tent from shaping the outside of the house to clothing the inside.

14.



23. Drew, Philip. 'The petrification of the tent: The phenomenon of tent mimicry.' In: *Architecture Australia*, v. 76, n. 4 (June 1987): p. 18 – 22. [ Drew becomes a primary source of reference within this thesis, writing a range of texts about many different aspects of the tent. ]

24. This approach of taking an element of the tent and rendering it solid has a similarity to the way that the tent is used in contemporary architecture, as described on the previous pages.

25. Quoted in: Drew, Philip. *New tent architecture*. New York: Thames & Hudson, 2008: p. 19.

26. Quoted in: Drew, Philip, 'Tent as symbol.' In: *LSA '86: The first international conference on lightweight structures in architecture* (chairman Paul Reid), p. 24 – 32. Sydney, 1986: p. 26.

27. There is another link here too, to the domesticity of a home (a home as the design project of this thesis). To explore this however, is outside the scope of this thesis.

Studio Dre Wapenaar, Dutch design group, uses the tent as a form full of meaning in their sculptural architecture. They have created a number of 'social sculptures' that are working tents, intended to begin discussion about aspects of life. *Birthing tent* (2003) is part of a series that looks at sheltering life's most intimate moments (16.). Dre Wapenaar are also famous for their *Tree tents* (1995 - ongoing). These are pods which hang in trees, also realising detailed aspects of the construction of the tent (17.).

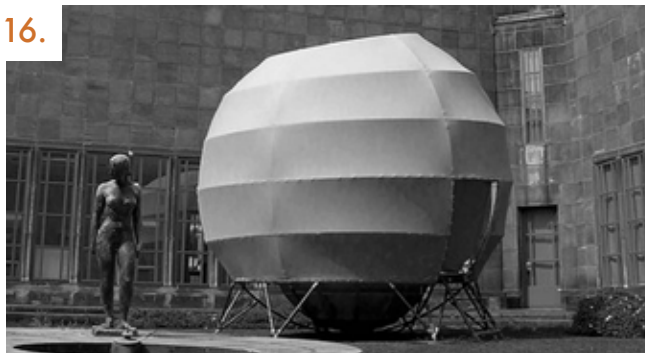
*'Tents, with the universal language they speak, are an excellent means to understand at least something of the chemistry between people.'*

- Studio Dre Wapenaar <sup>28</sup>

15.



16.



17.



The symbolic value of the tent expresses a rich tapestry of meaning that has been accumulated in its form throughout history. The range of symbols associated with the tent is varied, coming from many different cultures and human connections. These associations - more than being of specific importance - serve to remind us of the value in the depth of meaning contained in the tent, revealing virtues beyond the efficiencies of its construction.

28. Quote from their website homepage: <http://drewapenaar.nl/about.php> (accessed on 2/6/2011).

## [ THE INFLUENCE OF THE TENT ]

## Glamping

'Glamping' is a term coined recently, a merger of the words 'glamour' and 'camping', it means tenting, but in style. Glamping came out of the safari, where holiday-makers went to wild settings, but brought the furnishings of luxury accommodation with them - canvas tents being fitted with large beds, rugs and antique ornaments to create the comforts of home (18.) (19.). The trend of glamping is now gaining popularity, with campsites worldwide offering conveniences beyond what was once expected, and websites dedicated to the topic.

*'Several adventure groups saw an opportunity to cater to the needs of disillusioned campers who wanted to experience the positive aspects of camping without so many negatives. Thus the concept of glamping was born.'*<sup>29</sup>

18.



19.



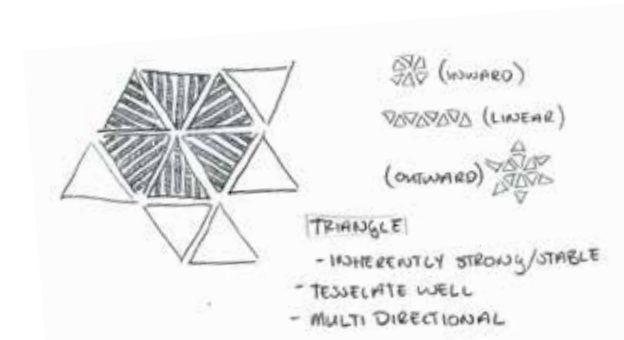
20.



Ocean Grove, New Jersey is an area that was founded as a camping resort in 1869, and which provides a holiday experience now that can be described as 'glamping'. At the *Great Auditorium campsite*, tents are built as suburban houses, and filled with everything that one would expect to find in their regular home. While the tent's construction appears very much like a conventional house at first glance, they are fully dismantled in winter (20.).

29. Taken from website: <http://www.wisegeek.com/what-is-glamping.htm> (accessed on 10/10/2011).

Glamping is the closest area that I have found related to readjusting expectations of the tent's potential to offer 'comfort', and of balancing the desire for efficiency against meeting the needs human inhabitation. However, glamping focuses singularly on the provision of conveniences, rather than any redesign of the tent. Examples of glamping are mostly conventional tents with draped fabric and regular furniture inside. I see the heavy furniture as contrasting with the lightweight form of the tent, and the draped fabric as somewhat cosmetic. Glamping reinstates the conventional comforts that people are used to, and does not actually address the true nature or potential of the tent as a beautiful and comfortable shelter.



#### Design question 2: HOW TO INCLUDE SERVICES THAT CAN BE RELOCATED EASILY?

The easy inclusion of plumbing and electrics is key to the design meeting expectations of modern convenience - simple to reinstall as the tent is relocated. An early idea that I pursued through design was of a tessellating floor module that contained these services, and insulated and raised the occupants off muddy ground also. By using a triangular tessellating arrangement, both a circular and linear layouts could be provided for within the geometry.



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[ THE INFLUENCE OF THE TENT ]

## Conclusions

There have been many areas influenced by different aspects of the tent, from its construction to its form and to its aesthetic. This study has tried to look mostly at those areas that have taken *direct* influence, as there are many more areas that contain similarities, although by chance.

Most influences of the tent have developed from either a more practical, or instead a more expressive stimulus, rather than a holistic understanding. And many of these influences then become almost quite unrecognisable in their new application - adapting materials and taking lessons from other areas too. However, while these deviations inspire forms that are not necessarily tents, they are useful to recognise within this thesis. In the influence of the tent there is a cyclical dialogue that creates a potential for the tent itself to be re-influenced:

Both structure and construction influences have advanced the technology and systems that are available to the tent, such as stronger materials and the anticlastic curve. The spatial experience and symbolic influence of the tent have emphasised aesthetic qualities and associated meanings that may not be apparent in the modern tent, and further suggest that the expression of fabric is compromised when it is rendered in solid materials. And glamping shows one way in which the comfort of the tent has been approached, helping to realise a greater potential for it beyond simply being a container for furniture.

The influences of the tent are the tangents of research and design that have already been followed in the wider world. Often, the critique that this thesis received was to follow the direction of the influence of the *form and space* of the tent, as applied to conventional construction - this is the architectural example of Glenn Murcutt and those other architects who use tented construction as a metaphor. However, while I have great admiration for these architects, this area has already been abundantly explored, and is only a singular aspect of the tent. Instead, the intention of this thesis is to take all aspects related to the influences of the tent, and to feed them directly back into it, rather than into a different solid form of construction.

This section has looked for inspiration outside the tent; now let's look *within* the tent itself.

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*'Brick tent'* (Auckland, 2011) made by New Zealand artist Peter Lange is a perfect example of how the tent has influenced a form that is quite unlike its true fabric self.

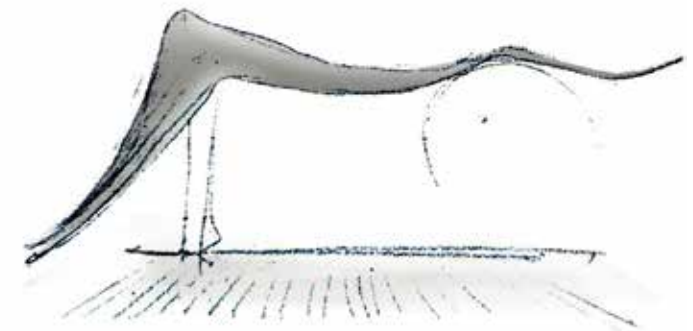


## THE ESSENCE OF THE TENT

The essence of the tent is a description that goes beyond literal characteristics related to structure, use and appearance. It goes beyond identifiable form and space to describe more abstract qualities that are at the core of the experience felt within tents. The essence of the tent is the intangible or ephemeral qualities that relate to its construction, but which are not the construction itself. It is in recognising the essence of the tent that we find a useful vehicle to reinterpret it within the design aspect of this thesis, without getting caught up in just replicating forms from the past.

In searching for the essence of the tent I produced a series of sketches and models that explored experiential qualities of the tent. I looked at aspects of its construction, from form and structure to materials. I contrasted it with heavier construction. I looked at spatial relationships and human relationships. I looked to a number of keywords that came to mind and then largely, I followed the intuition of my own experiences.

One of the first images that I drew in my sketch-book was the curvaceous form of a fabric canopy. This sketch was not part of my search for the essence of the tent, but I later realised that it captured just that quality. Without recognisable form, the shape in the sketch seemed to float weightlessly, it peeled back to invite the outside into the inside, and it rippled as it did so. The realisation in this sketch did a lot to begin my understanding of the tent's essence, further insights then added colour to this picture.



Early sketch embodying the 'essence of the tent'.

The tent is a very different form of construction than the majority of buildings that we daily encounter. The tent is incredibly light-weight, and its shape is quite often not square. If 'essence' is related to construction, then it is in the tent that we see the use of a covering skin, often made of fabric, as the distinguishing feature which sets it apart from all other types of building. Thus the search for the essence of the tent is largely an exploration of fabric qualities.

Contraction and stretch, three views.



## Fabric

Fabric is soft, sensual and comforting. It is known intimately to every single person as the material that they daily wrap their body in, as a second skin that provides protection and expression of personal taste. Clothing has given fabric a powerful vocabulary of meaning, and similarly through clothing, fabric has achieved a high level of refinement in manufacture and construction methods.

Fabric is unlike almost all other construction materials, it is not hard, it has real responsiveness. Where masonry is an impenetrable blockage, fabric is a permeable filter of light and greater awareness. Where solid walls stand still and dead, fabric moves in response to our gentle touch. Where concrete, steel and lumber require trucks, specialised tools and hours of labour, fabric can be sewn folded and transported within the means of our human bodies. And where a house is a box that may be opened, a tent is a package that may be unwrapped.

DESIGN: The design process running concurrently alongside research made marquettes that explored 'the essence of the tent'. As I made and documented these surfaces and effects, I imagined how they could be re-injected back into a tent. Some of the marquettes I could see placed literally as walls, and others I could see more abstractly - as metaphor of spatial flow or form.

## [ THE ESSENCE OF THE TENT ]

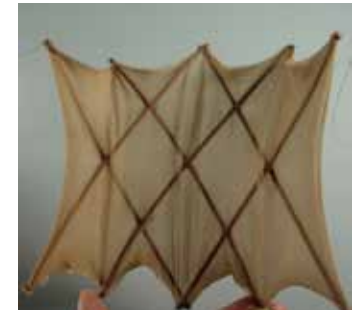


Wind ruffled tabs, three views.

## Flexibility and movement

Extending lattice and skin, four views.

A quality innate to fabric is its fluid flexibility. Fabric possesses an infinite range of movement; it folds, wraps, stretches, drapes and flutters. Fabric's ability to respond to changes in its environment is the quality that gives the tent its adaptability. It is in the movement of fabric that the tent gains the greater movement of its ability to be transported.



Tents embody movement even where there is stasis. Tensile structure is a dynamic balance between the forces of tension and compression, between *pulling* and *pushing*, with the aim of creating equilibrium. In tensile structure this dialogue is revealed to all who care to look, so that the structure has a poised sense of being alive - tethered, but unpredictable and ready to jump up at any moment (just like a true nomad).



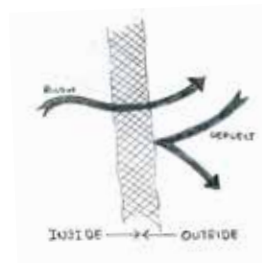
## Permeability

The millimetre thickness of fabric allows it to move, and this feature then gives rise to another quality of the tent, its permeability. While all architecture must mediate between an inside and outside environment, the tent does this somewhat more uncontrollably.

The permeability of fabric is an unavoidable aspect that means the elements of light, sound and heat, and even sometimes the more substantial elements of water and wind, can pass right through. The transmission of elements is both a positive and a negative virtue - at its worst it is called 'uncomfortable, un-private and un-insulated', but at its potential best it is called 'connection with the surroundings'. The common saying, "*why did you leave the door open... were you born in a tent?*" relates to the permeability of tents. The lightness of their skins allows an awareness of the outside world, so that tents have perhaps what could be called the ultimate 'indoor-outdoor flow'. In a tent, awareness of the outside filters through from every direction - not just through punctuated window apertures. This permeability means that, although the tent is autonomous in its ability to be relocated, wherever it is placed it becomes intrinsically connected to the site.



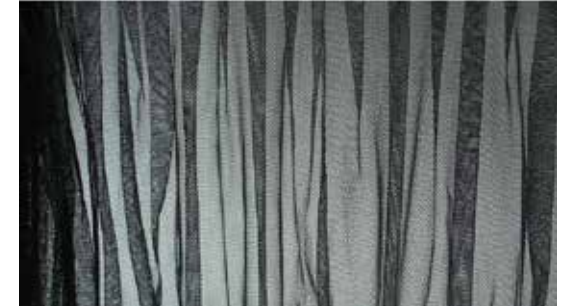
Layers, two versions.



DESIGN: The permeability of the tent is an asset for creating beautiful space. However, in the modern tent, permeability has become absolute through the quest for lightweight efficiency. The permeable nature of the tent should instead be a balance between *allowing* and *deflecting*, so that the best of both *connection* and *protection* may be gained.

## Light and shadow

Translucent gathers.



The way that light meets fabric is different from the way it meets other solid building materials. The permeability of fabric means that light not only illuminates the surface, but it also passes through the material, revealing its thickness or the depth between layers. The light that passes through then also reveals whatever is behind the fabric in diffused light. Thus light serves to activate the material, and the fabric then responds by altering the quality of light that passes through it.

Different light qualities can change the mood of spaces, and the contrast between daylight and artificial light can give especially different qualities. Lighting effects can give the tent yet another way to change its appearance - during the day when light filters from outside into the inside space, and at night when it returns the favour, glowing back outwards like a lantern.

Shadows cast by a tent are different than other shadows, due to the permeable nature of fabric. They are paler, and less defined. And those shadows that are cast upon the tent meet its curved surface uniquely - wrapping and sliding around it with a gentle gradient that hugs its contours. Like light, shadows also have the ability to change overall appearances, by defining, exaggerating and concealing. The difference between light and shadow acting on a tent being that, while light reveals the fabric surface, shadow reveals the curvaceous form.

*'Shadows are always ephemeral and intangible, which is precisely the emotional characteristic that makes shadows profound sources of fascination, and makes them such powerful design elements.'*<sup>30</sup>

30. Petschek, Peter & Siegfried Gass. *Constructing shadows: Pergolas, pavilions, tents, cables and plants*. Basel: Birkhauser, 2011: p. 55.



Centre and edge light source, two views.

Back-lit revealed pattern.



DESIGN: The use of light and shadow can be used to create a sense of *privacy* or of *solidity*. Shadow can be used to create *seclusion*, and light passing through multiple layers can reveal the depth between surfaces - rather than just the thinness of fabric - giving a greater sense of *substantialness* to the tent. These qualities are integral in making a tent that provides the perceived *security* of a home.

## [ THE ESSENCE OF THE TENT ]

## Geometry

The often round form of tents comes from their unique tensile structure, and this contrasts with the compression components of their construction - which are straight in the case of poles - and the flatness of the ground on which they sit. The tent juxtaposes curved and flat forms like no other construction method, so in trying to recognise the essential quality of the form of the tent I explored a dialogue between the curve and the straight line.

The straight line is a continuum; it extends on indefinitely in a singular direction, without ever turning - if it wishes to change direction, it does so with a sharp angle. However, a curved line, of whatever arc, is always turning, and will eventually come around to meet itself again. And so the line is related to the *square*, and the curve is related to the *circle*.

Square and circular volumes have different spatial qualities, and where the square is the shape that we are most used to living in, the circle is the plan of many tents, especially traditional ones. A curve has two sides, one that faces inwards, and one that faces outwards - its concave side creating a sense of *inclusion*, and its convex side creating a sense of *exclusion*. This contrasts with the straight line, which instead has a sense of *extension*, so that while the curve may look inward, the straight line looks onward. The spatial qualities of these two basic geometries have led to different approaches by architects and theorists. Glenn Murcutt takes inspiration from the ability of the straight line to connect with the landscape, whereas Gaston Bachelard describes the curve's ability to protect.

*'I follow the contours [of the landscape] because the contours are elements which by definition are horizontal lines.'*

- Glenn Murcutt <sup>31</sup>

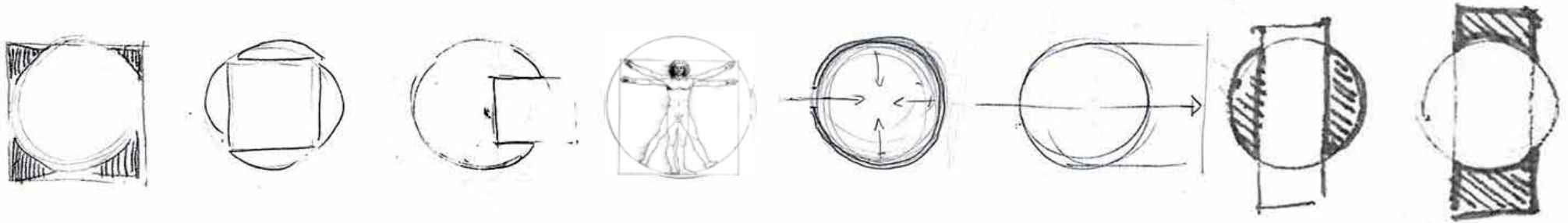
*'The grace of a curve is an invitation to remain.'*

- Gaston Bachelard <sup>32</sup>

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31. Glenn Murcutt quoted in: Drew, Philip. *Touch this earth lightly: Glenn Murcutt in his own words*. Australia: Duffy & Snellgrove, 2001: p. 97.

32. Bachelard, Gaston. *The poetics of space*. Massachusetts: Beacon Press, 1958: p. 146.



Meeting of the circle and the square.

Initially I associated the square with *stasis* and the circle with *movement* - indeed the circle is the shape of the wheel. However, broken down into parts these associations swapped over, so that the straight line projected and extended, and the curve enclosed and provided stillness. Thus the curve, while expressing movement, has the paradoxical power to provide immobility and restfulness - and this is an important aspect of any homely space, such as is relevant to the design portion of this thesis.

DESIGN: The differing emotive qualities of the straight line and the curve have the ability to respectively connect the tent with the landscape it sits in and to provide the privacy desired in a home. Of the structural forms of the 'skin tent' and the 'frame tent', I see that the skin has linear qualities, whereas the frame (as a dome) is related to the curve. This association creates a form where hoops contain internal space and provide privacy, with an outer skin stretched tautly over to connect in a linear relationship with the landscape. This places a frame tent within a skin tent, and is diagrammatically the picture of a circle within a square.



## [ THE ESSENCE OF THE TENT ]

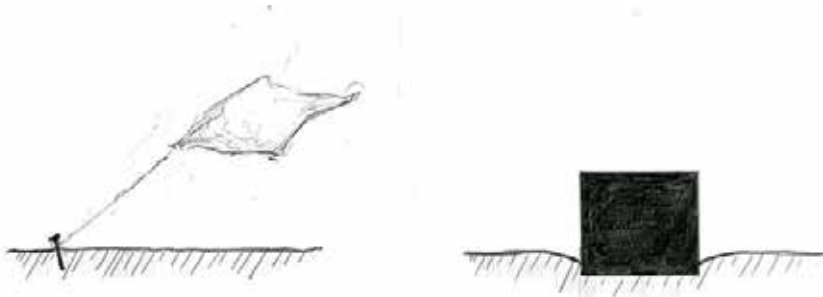
## Conclusions

The 'essence of the tent' is those qualities that relates to its lightweight construction, with fabric allowing softness, movement, permeability, and flexible curved forms. The tent is a shelter that is always changing; in shape, in place and in appearance. It has geometry that can look both inward and onward. It is reflexive, and it adapts to and echoes its surrounds. The tent is a highly flexible form, and its essence embodies this; as something moving and never static, and as something that is always *responsive*.

Upon planning and photographing the maquettes of this exploration I found that I relied on lighting effects, wind and movement, and time-capturing serial vision, as much as I did on the models themselves. From this I gained an understanding that the essence of the tent reaches further than its construction, and that ephemeral elements actually play an important role in shaping the spatial quality of the tent also. For, as much as the essence of the tent is intrinsic to the fabric of its construction, fabric simply acts as a mediator that reveals the greater movements that happen around it. The essence of the tent thus relates to factors that are of the tent's use and placement, aspects of which give it meaning beyond its own form - just as blowing wind also gives meaning to an instrument.

*'The difference between architecture and architecture in motion is all a matter of the perspective that you take. One of the great insights in modern physics is that you can look at physical things as both objects and processes.'*

- Jennifer Siegal<sup>33</sup>



The tent is tethered to the ground, pulling away from it.  
This contrasts with the gravity of heavy construction.

33. Siegal, Jennifer. *More mobile: Portable architecture for today*. New York: Princeton Architectural Press, 2008: p. 21.

The relevance of the 'essence of the tent' is that it describes qualities which are at the heart of its architectural expression, and as architectural recognition is questionable in the modern tent, so too it is these essential qualities that are often lacking. Fabric no longer provides the tent with soft intimate comfort, and its minimised thinness has led to a form that is *too* permeable, lacking in privacy and insulation. And some forms, like the rectangular marquee, have even lost the curvaceous shape of tensile fabric altogether.

But in the midst of this we also find an answer for reinstating the essence of the tent and architectural appreciation. If the tent's essence relates to ephemeral qualities, then the beauty that this thesis seeks to find may be found in the tent's response to the nature of its inhabitation. By replacing the current design focus on its temporary usage to that of its functioning as a *home*, an ongoing duration of inhabitation is specified which allows space for an awareness of the tent's daily changes. And by giving *less* focus to primarily maximising efficiency, the tent is given the freedom to re-emerge refurbished with a heightened attention to the creation of the pleasurable qualities that are the essence of the tent.

Following research looks at aspects that make a shelter into a 'home'.



Design image.

## HOME

In fitting the function of a *home* into a tent, the approach is not of simply fulfilling the provisions of all amenities, but instead of satisfying the personal connections which give this type of shelter *meaning*. Thus research is directed toward the aspects that make a home *recognisable*, and that make it feel *welcoming*.

To keep this wide topic within scope, interpretations will be kept general and applied to a New Zealand understanding.

### The form

A colonial home; built of timber, free standing and pitch roofed.

The form of a home is the generalised characteristics that describe similarities across a range of examples.



In New Zealand we have a common lightweight method of domestic building which is based on timber construction. Houses are often built as independent structures, standing in the midst of lawn and garden, with a deck out front and a pitched roof on top<sup>34</sup>. These elements of its form are recognisably familiar, and are common from colonial times, where they developed as a response to an abundantly forested landscape which provided high yields of timber, space in which to build and an earthquake temperament that taught settlers of the value in the flexibility of timber. While the initial perception of timber homes did not immediately fit public perceptions of what a home should look like<sup>35</sup> - the preference instead being for the permanence of brick - this form endured from *bungalow* through to the present day, having now been transformed by modern building practice to fit large glass windows and to open up spatial configuration for the maximum 'indoor-outdoor-flow'.

34. Bingham-hall, Patrick (Ed.). *Houses for the 21<sup>st</sup> century*. Australia: Pesaro Publishing, 2003: p. 60.

35. Skinner, Robin. 'Understanding the risk: Seismicity and architectural development in nineteenth-century New Zealand.' In: *Fabrications: The journal of the society of architectural historians*, Australia and New Zealand, v. 19, n. 1 (June 2009): p. 122-139.

## The feeling

The home is a shelter particularly loaded with meaning. The very term 'home', as distinct from 'house', lends affection to the description, extending beyond its built form to express emotional needs. The following three theorists describe different key aspects of what makes a home.

**Claire Cooper-Marcus**<sup>36</sup> explains that the home fills a role which satisfies psychological needs of *belonging, familiarity and security*, and that it communicates *territory*. Through this Cooper-Marcus describes that a home is a trusted and safe place to return to, and that 'home-sickness' is simply a change of routine that disrupts our satisfaction of these needs.

**Witold Rybczynski**<sup>37</sup> deals with aspects of inhabitation which are related more closely to the body. He describes that a home provides *comfort and privacy*. But while he describes that both of these qualities are important, he also historically accounts that our value of them has only developed in the last couple of hundred years, and that an absolute of either can actually make life dull.

**Gaston Bachelard**<sup>38</sup> takes a philosophical approach to discussing the nature of a home. He suggests that the associations that make a home are so ingrained in all of us that we need not explicitly distil them in order to understand them. He explains that home is a quality close to us all and that we understand it simply because we have all lived in one.

*'The virtues of shelter are so simple, so deeply rooted in our unconscious that they may be recaptured through mere mention, rather than through minute description. Here the nuance bespeaks the color. A poet's word, because it strikes true, moves the very depth of our being.'*

- Gaston Bachelard<sup>39</sup>

36. Cooper-Marcus, Clare. *House as mirror of self*. Berkeley: Conari Press, 1995.

37. Rybczynski, Witold. *Home: A short history of an idea*. England: Penguin Books, 1986.

38. Bachelard, Gaston. *The poetics of space*. Massachusetts: Beacon Press, 1958.

39. Ibid. p. 12.

## Conclusions

The typical New Zealand home, seen as a generalisation, is a shelter of relatively lightweight construction that stands independently in the landscape and has high consideration for its 'indoor-outdoor-flow'. In these qualities we find a basic description of form that could also be made of the tent, and as a result a common basis which can be used to allow the tent to develop into the recognisable image of a home. Without replicating the literal appearance of a conventional house, the tent can reference basic similarities to convey simple elements that are recognisable of domestic space.

Cooper-Marcus confirms the relevance of reflecting the form of a conventional home in the design of a tent-home by revealing the domestic value of '*familiarity*'. And her further definitions of domestic aspects are also useful in shaping the design; with the need for '*security*' suggesting consideration of how the tent's thin fabric skin can provide this, and '*territory*' questioning how transportable elements can express *belonging* within the landscape. In satisfying these expectations however, the tent offers a unique opportunity - by allowing someone to take their home with them when they move, it allows the continuation of a sense of familiarity, security and territory, and thus cures 'home-sickness'.

The fate of the modern tent in its inability to provide for intimate inhabitation is confirmed by Rybczynski, who describes that homely space is characterised by a desire for '*comfort*' and '*privacy*'. Whereas once these provisions would have been met in nomad tents by cushions and curtains, their place has now been stripped, and thus they require refurnishing. While the quality of *comfort* is inherent to fabric, its ability to provide *privacy* is less apparent - however, Rybczynski's warning that *too much* of either of these aspects can make life dull, offers a chance to reshape our understanding of how to meet these needs while still experiencing the beauty of the permeability of fabric.

### Design question 3 : CAN A TENT HAVE MORE THAN ONE LEVEL?

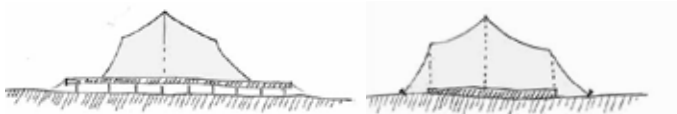
To test my assumptions of the tent I asked - can a tent have more than one level, can it be two storied - or more? I came to the conclusion that any upper level must not create the undue sense of weight for the level below, and that it must also be incorporated in such a way that an awareness of the whole internal space is maintained throughout. By using tensile principles, the upper level could be a membrane similar to a hammock or trampoline. This type of space, for privacy requirements, would be a potential location for sleeping.



Bachelard completes the description of what a home is by reminding us that, to recognise a home we don't need to unduly dissect it, but instead just look inside ourselves. Like Rybczynski before, this echoes a description that the impersonal shell that the modern tent has become has left it without the ability to engage any instinctual recognition of homely virtues - and thus validates a return in the focus of design; to recognise and provide for the personal presence that an occupant gives to the shaping of space.

The design of a tent to function as a home is never going to reflect the exact way in which our current expectations of these shelters are satisfied. It will never be a carbon-copy of a conventional house. However, between the tent and a home there are still general similarities in spatial form which can be maintained, and certain emotional and functional needs that can be met. Rather than striving for a literal description of a home, an awareness of the subtle qualities described on these pages can recreate the basic atmosphere of a home within a tent. By looking to the tent for its own intrinsic nature, the design aims achieve this through fabric means.

The next research section looks more closely at structural and material aspects of the tent's construction.



#### Design question 4: HOW DOES A TENT TOUCH THE GROUND?

The light-weightedness of the tent requires special consideration of how it touches the ground, so that it does not feel bound to it, but so that it also feels connected to it. An earlier design concept of using a floor pallet module is relevant here, in that such a floor could be configured to smoothly step up in level from the outside through into the inside - likened to a continuation of the landscape in itself. The detail of how the wall is pinned to the ground is a key to consider also. By extending the wall beyond the flooring, the whole structure reads as being tied to the earth, rather than just placed upon it.

## TENT CONSTRUCTION

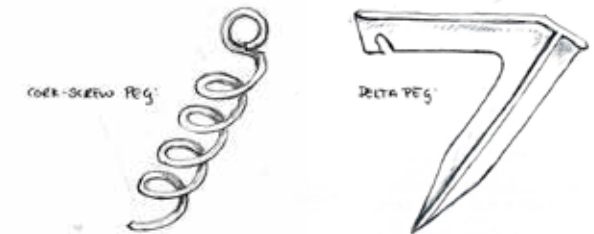
### Structure

The full radius of spreading forces in a stretched surface is a complex calculus and early structural developments in tents did not happen by pages of equations, but instead as lessons of trial and error. This approach was similarly followed by modern tensile engineering where the physical measuring of scale models and computer simulations revealed form. So in the same vein, as the scope of this thesis is *aesthetic* rather than *mathematical*, I will delve into tented structure only on the level its form, and forego describing it through equations and explicit descriptions<sup>40</sup>.

While the forms created by tensile structure may initially seem unlimited, as indeed the flexibility of fabric is, there are reoccurring similarities of cones, domes and particular curves that can be recognised similarly across many different tents. These forms are the vocabulary of tensile structure and describe shapes that are stable and strong, that have defined tents through history and that will naturally become a reoccurring theme through design. The distinction between 'frame tents' and 'skin tents' made earlier in this thesis has described two basic ways in which tensile structure works, and the 'anticlastic curve' has been identified for its ability to give uniform tautness to a fabric surface.

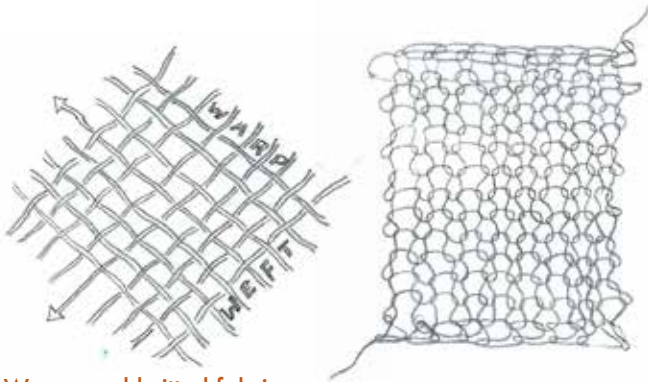
### Components

**Tent peg:** The corkscrew peg achieves greater grip against being pulled out of the ground, and the 'delta' peg eliminates leverage. 'V' flanges prevent a peg from rotating in the ground.



**Supporting structure:** Of structural materials for use in support of the tent's skin, timber, steel, aluminium, and fibre-glass are all relevant of consideration, all having different spanning abilities, flexibility, durability and beauty, and thus suiting them to different uses. Timber can be laminated to create beautiful hoops or poles, but can also require a thick diameter and be heavy. Bamboo however, is very strong compared to its light weight. Steel is strong and allows slender diameters, but can be prone to rust and is unpleasantly cold to the touch. Fibre-glass and carbon-fibre are extremely strong materials, and are suited to a flexible use as hoops.

40. For more mathematical detail describing tensile structure, see: Otto, Frei. *Finding form*. Germany: Deutscher Werkbund Bayern, 1995. Or also: Berger, Horst. *Light structures, structures of light: The art and engineering of tensile structure*. Berlin: Birkhauser Verlag, 1996.



Woven and knitted fabric .

**Fabric skin:** The skin of a tent has many needs to meet. As a structural element it must have the strength to span and resist loads without ripping, and as a cladding it needs to be waterproof, airtight, fire resistant<sup>41</sup> and durable. It also needs to provide thermal and acoustic insulation, and furthermore to meet the brief of this project it needs to express beauty.

Fabric has developed a long way since the first tents. From using tanned animal hides and thick cloths of woven plant and animal fibre, tents are now skinned in lightweight materials that meet many of the needs just stated. Most of these fabrics are woven, but there are also some cases where the elastic stretch of knitted fabrics and homogenous plastic membranes are useful.

When choosing a fabric there is a dialogue between the virtues of either a natural or synthetic material. This dialogue is half in part about sustainable concerns, and half about tactile beauty and appeal. The ecological virtue of natural materials, like cotton canvas, is that they come from a renewable resource and biodegrade easily. Beside some other aspects of their manufacturing process - such as toxic dyes - they are less polluting to the environment than synthetically manufactured materials. Thus the tricky balance that must be achieved between natural and synthetic materials is a comparison of their user properties, environmental impact and aesthetic appeal. While natural fabrics appear better in terms of manufacture, synthetic fabrics are often better in durable performance. P.V.C. can more than double the potential life span of cotton canvas, and so the losses in the manufacture process are balanced by not having to replace the material so often. However, natural materials offer a tactile quality that is somehow superior to synthetic fabrics. Natural fabrics have fibres that come from life - from growth itself - and this quality is still present in the woven cloth. Natural fabrics have a softness and movement that is unlike synthetic fabrics, and the replacement of natural fibres with synthetic ones in the modern tent directly relates to the loss of this beauty.

I looked at many fabrics during this thesis. Following is a summary of the four that are of direct relevance as *structural or outer layers* within the design.

41. Tests show that, although fabric is combustible, it will not create a long burning fire and will burst seams quickly and so vent heat. Thus fire danger in fabric structures is not often life threatening.

## [ TENT CONSTRUCTION ]

**Canvas:** Canvas is a woven cloth made from either natural or synthetic fibres, both of which give it different properties of strength, durability and tactile beauty. Canvas is the material that has replaced many of the skins of traditional tents, such as the yurt and tipi.

Cotton is a natural, renewable resource / Polyester is a synthetic fibre

High light transmission, especially in lighter colours.

Flammable, but can be fire-retarded

Can be U.V. treated

Porous. Movement with moisture, but can be water-proofed (The advantage of canvas is that it breathes)

5 – 15 year life span

**Poly vinyl canvas:** P.V.C. is a composite fabric that achieves a totally waterproof surface by filling any gaps in its woven polyester substrate with a plastic coating. It is stronger than most canvases and is the most common choice of many marquees.

Comes from synthetic source, can be recycled

High light transmission, especially in white, but special types also offer low light transmission

Fire-retarded

U.V. resistant

Water-proof, sealed plastic-welded seams

20 + year life span



**Shade cloth:** Traditionally used in the horticultural industry, shade cloth is either woven or knitted. Different densities provide degrees of shelter from the sun, but still let the wind and rain pass through. [ Product: 'Ultra-Block' ]

Woven or knitted from synthetic strands

Light transmission depends on density of weave, designed to cast shade

Flammable but can be fire-retarded

U.V. treated

Surface is highly perforated and allows rain through, although denser weaves have greater water surface-tension

10 – 25 year life span

**Boat coverings:** Fabrics used in marine applications may find relevant use in tent construction. Many are made of coated polyester, however are thinner and more supple than P.V.C., being more suited to being folded or rolled up. [ Product: 'Top-Gun' ]

Synthetic fibre and coating

Medium light transmission

Flammable but can fire-retarded

U.V. treated

Very waterproof

5 – 10 year life span

[ See Appendix 2. for fabric samples ]



## [ TENT CONSTRUCTION ]

## Conclusions

An investigation of the architectural qualities of tents cannot be made without consideration of the affect of their structure, as tensile construction inescapably defines form and thus spatial atmosphere. The form of the 'skin tent' - as the lightest weight tent in which the skin is pulled *taunt* between supports, rather than just *wrapped* around a freestanding framework - has been noted as the structural type that contains the strongest expression of aspects described as key to 'the essence of the tent'. The skin tent brings attention to the curvaceous forms and responsive properties unique to a fabric skin, and thus the structural forms that are of highest relevance to design are those that relate to the 'Black tent', supported by singular poles or hoops.

The properties of construction materials relate not only to structural strength, but also to tactile and visual beauty. A comparison of natural and synthetic materials shows that synthetic fibres often satisfy structural and durability requirements, whereas natural fibres satisfy aesthetic (and environmental) concerns. For meeting factors of strength and sheltering I see the use of P.V.C. and shade cloth suited to use as an outer skin for the tent, and for providing tactile and visual beauty, I see the use of fabrics made of natural fibres more suited to the inside where their texture can be appreciated at close range.

The role that construction plays in reclaiming the architectural beauty in the tent is that structural concerns shape overall form, and material choices refurnish detail and texture.



Layer

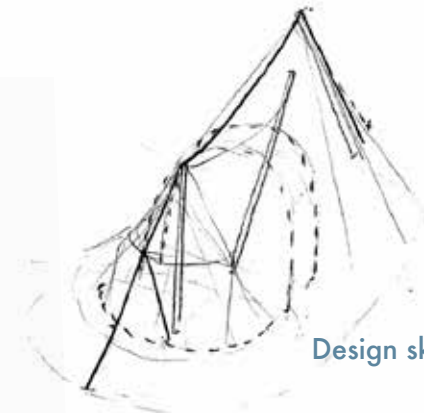
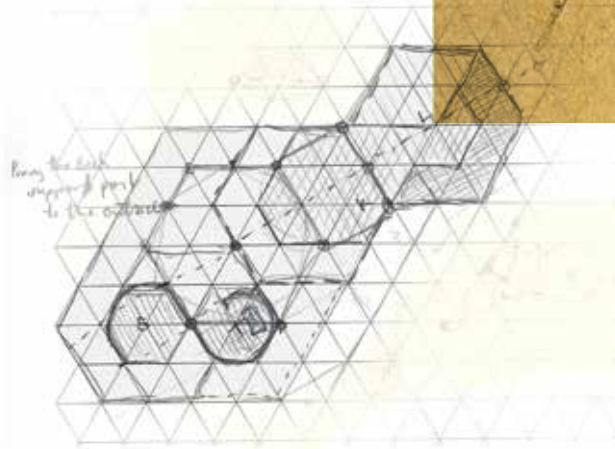
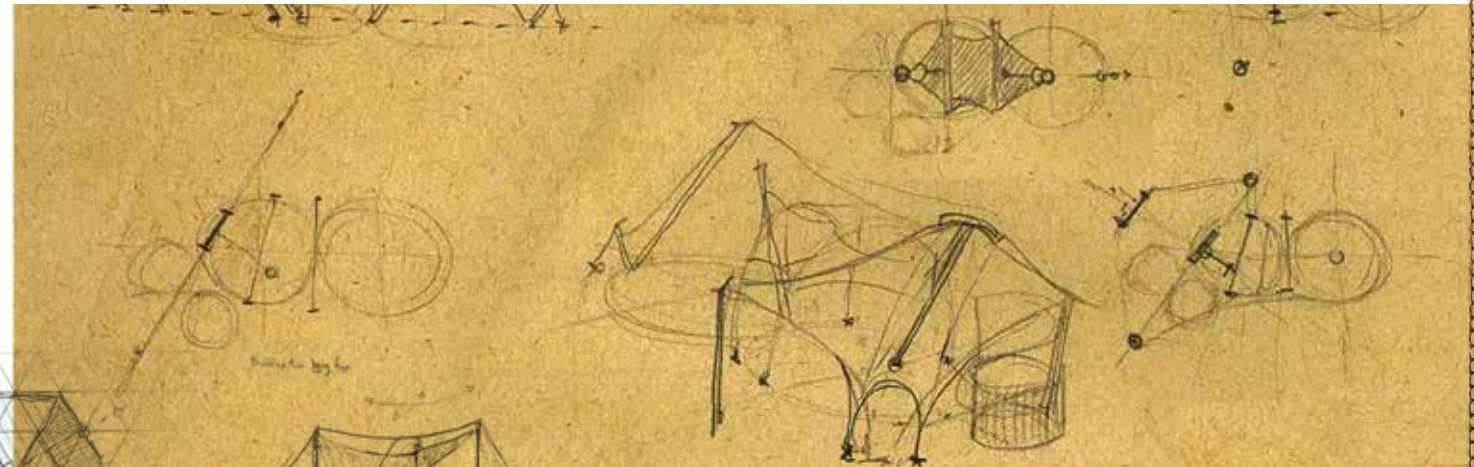
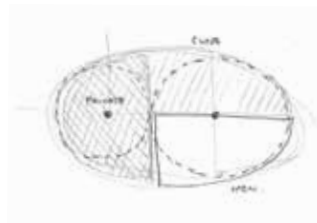


Contour



Stretch






Design sketches



Fabrics from design process.

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*'We no longer believe in the monumental, the heavy and static, and have enriched our senses with a taste for lightness, transience and practicality ... We shall live no longer than our houses and every generation will have to make its own city'.*

- Antonio Sant'Elia, 1914 Italian Futurist Manifesto <sup>42</sup>

DESIGN

42. Translation taken from: <http://www.unknown.nu/futurism/architecture.html> (accessed on 7/8/2011).

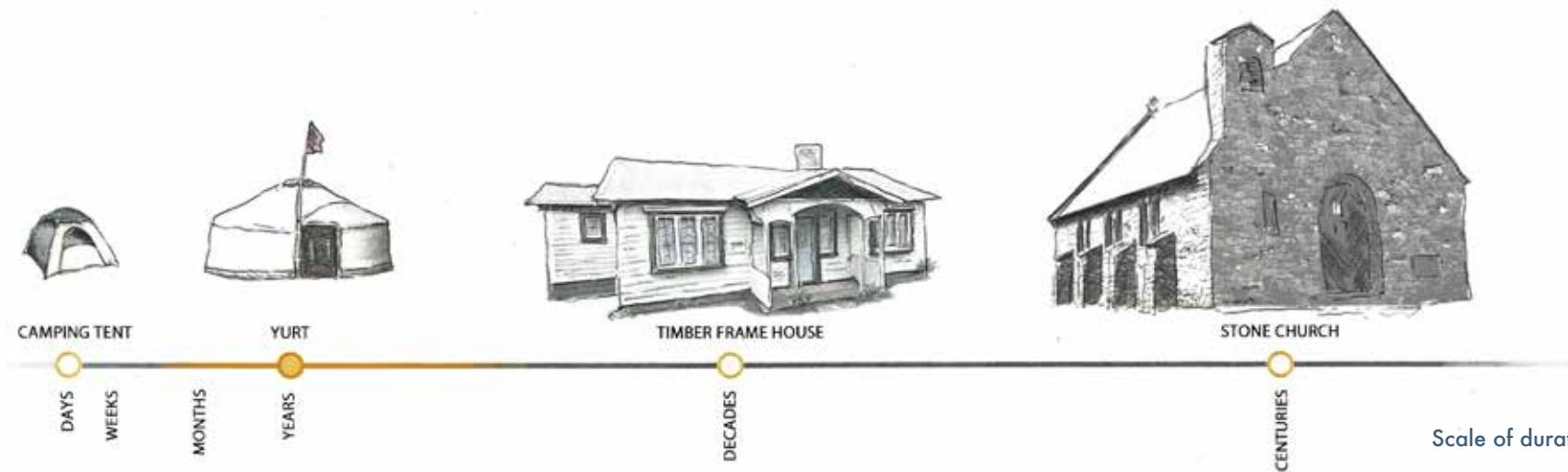
## DESIGN BRIEF

The design is of a tent that considers the beauty inherent to fabric construction. It does this through addressing the *comfort, aesthetic* and *meaning* that come through its functional use as a 'home'. In designing a tent to be lived in, its form will be reshaped by a set of parameters that consider the relationship of the user to the space, this intimate use providing the spark for re-establishing the architectural beauty of its construction.

To ensure that the beauty of the tent is given the best chance to emerge, and that the thesis does not get diluted or compromised of its focus, the brief will not pursue a specific client as the basis of design, but instead will view domestic function through the more general factors that shape our understanding of a 'home'. Thus, while designations of cooking, washing and storage will indeed be considered, the approach will take greater reference to the deeper personal connections that give meaning to domestic space.

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It is intended that the design, like the yurt, will have a lifespan that is approximately between 5 – 20 years of *daily* use.

The design will require thinking as to how the tent can be shaped to meet expectations of what makes a home, but also of how the tent itself can provide unique opportunities to redefine how we use our homes as well.

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## Design method

A question about design process and outcome is inherently related to the tent. As vernacular constructions, most traditional tents were developed over generations without a singular architect, so that their design process was one of transmission, adaptation and refinement, and this means that there was no singular defined outcome of form. In contrast, modern design practice gives importance to authorship and originality, and this raises immediate questions about the design of a new tent. By being an adaptable and responsive structure, even its modern form still holds the potential to be altered by its occupants - or the conditions of its location. And thus its design is always inherently in a state of *process*, achieving only momentary outcomes, and always holds the potential to be influenced and changed beyond the control of any initial designer.

With this consideration in mind I saw that the design of this thesis could go two ways. Either it could be highly considered and include a range of options for adaptations, or it could be a broader exploration, covering many bases, but with less specific detail. As the first option seemed unable to interact with true input from a user and was limited to speculation, I opted for the second approach. Rather than a single outcome, this thesis designs of a range of different, yet related ideas. It is an exploration - such as the history of the design of tents is.

The design process involved pages of sketches and the making of many chop-stick and panty-hose models. I found modelling a particularly useful practice, as it immediately revealed forms in three dimensions, and made clear - on miniature scale - the unavoidable truths of tensile structure. Each model or sketch enriched or tested previous ideas, and inspired new ones. Many times I found re-occurring themes and overlapping of concepts that made design a cyclical process. I hope that the following pages may read similarly as my sketchbook, full of many different ideas, some potent and others not, but all relevant.

## Relationship between research and design

The design follows from research presented so far, materialising form out of understandings of the structural and spatial essence of many different examples of tents. This is not a simple linear process however. Initial consideration of the design began with questions that I asked myself and maquettes made during research for 'the essence of the tent', and further research is presented throughout the design process, matching questions raised by function, construction and recognition of unsuccessful aspects of design. Thus research and design are interwoven and equally inform each other.

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The lightweight construction of the tent allows anyone to give a hand in its building.

[ Keywords that have been distilled from 'the essence of the tent' that may act as inspiration for design :  
supple – slender – delicate – surface – responsive – textured – filter – flex – curve – adapt – stretch –  
wrap – fold – drape – move – connect – tether – change – balance – extend – enclose ]

## Purpose of design

The purpose of design is to further understand - both as applied research and to express to the reader - the architectural potential of the tent. Design gives the theory a physical form that tests its validity, and also serves to communicate in more direct terms the implications of such research.

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## SITE CONSIDERATION

The siting of a project gives a set of parameters, and initially I considered using multiple sites that could inform design in different ways:

I considered structural advantages in places where the ground is unstable, such as on reclaimed land, or in Christchurch - post 2010 and 2011 earthquakes - as a quick replacement housing option that would need to satisfy psychological issues of temporality and perceptions of social fit. I considered extreme climates, such as Central Otago where nomadic fruit pickers need seasonal accommodation, and climate response would be tested. And I considered the tent's relationship to permanence by siting it within the city atop buildings, the cityscape becoming a landscape, questioning the level of desirable permeability and of 'grounded' connection.

However, although all of these sites may justify a valid placement for a tent, they also made the project too specific and did not allow freedom to engage fully with the core aspect of the thesis - the aesthetic beauty of the tent.

The transportable nature of the tent means that there is no singular site that defines its form, which it directly responds to in terms of its layout or appearance, but instead of a number of different potential sites. The tent is defined by its ability to move from one location to another, rather than be left in only one place, and as a result the physical conditions of any singular site that have the greatest implication for the construction of the tent are simply the availability of clear, dry and relatively flat ground - the tent itself otherwise being readjustable in its orientation to sun angles, prevailing winds and views

But conversely, the 'essence of the tent' is directly related to its landscape connection. The tent never sits independent of its setting, because wherever it is placed, its form and material allow awareness of the surroundings. The wind ripples the fabric, daylight filters through and the interior is always aware of what is happening outside. In this way, contrary to the generalised transportable site-relationship of the tent, tent and site in fact become inseparable, with specific attributes of its particular location always directly influencing the tent's appearance and atmosphere.

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The tent is an open form that gains great awareness of its context.

This non-defined and yet absolutely responsive dialogue between the tent and its placement lead to conflictingly generalised and specific questions about the selection of a site. To deal with this, and to find a stable basis to yet inform design, another way that we may look to 'site' is as the parameters that define the requirements of its use. By fitting 'site' as the needs that relate to the design's use as a *home*, the tent gains a constancy that transcends its transportation from one location to another, and that at the same time creates a filter which - rather than negating any consideration about the physical site - actually focuses consideration of it. This views 'site' through how it relates to the tent's domestic use; of how spatial flow between inside and outside fit homely expectations and of how its transportable form can express a grounded sense of territorial belonging. Furthermore, by looking to the site as the factors that relate to the tent's function, the earlier intention to use human inhabitation as a key for reclaiming architectural beauty finds itself a place to actively reshape the tent.

[ Key words relating to qualities of a *home* that may inspire the design: **belonging – familiarity – security – territory – privacy – comfort** ]



## DESIGN ITERATIONS 1.

The first iterations of design developed from the basis of the 'skin tent', where the fabric cover is stretched from supporting poles to create forms that most truly express of the unique shape and volume of fabric construction. These first models were primarily structural lessons and developed an understanding of the self-determining surfaces of tensile construction and of how to achieve an equilibrium of forces. The interplay between tension and compression elements - and of their curved and linear geometries - inspired models which were viewed for the value of their overall form and for their harmonious balance and beauty.

To fit the functional brief of meeting the basic requirements of a *home*, separation between public and private areas was part of this structural consideration. However, as the 'essence of the tent' describes a unified form that is inherently permeable and interconnected, to subdivide into segments with simple partitions walls goes against its own spatial nature and is not a valid approach. For this reason, while indeed a necessary part of re-establishing inhabitation of the tent, functional separation must also be achieved with heightened sensitivity and do so through fabric means in a way that does not compromise the tent's own expression of beauty. The following models explore ways in which a tensile structure can respond to creating areas of spatial separation.



### Methods for separating space:

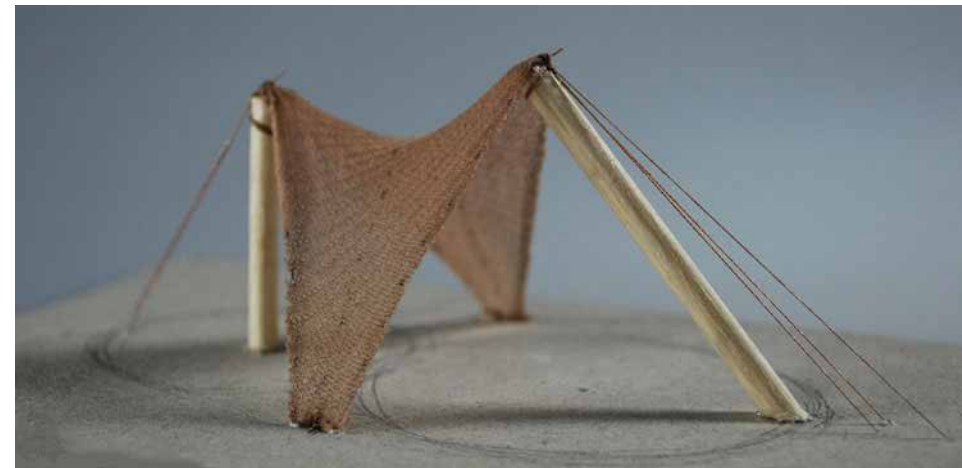
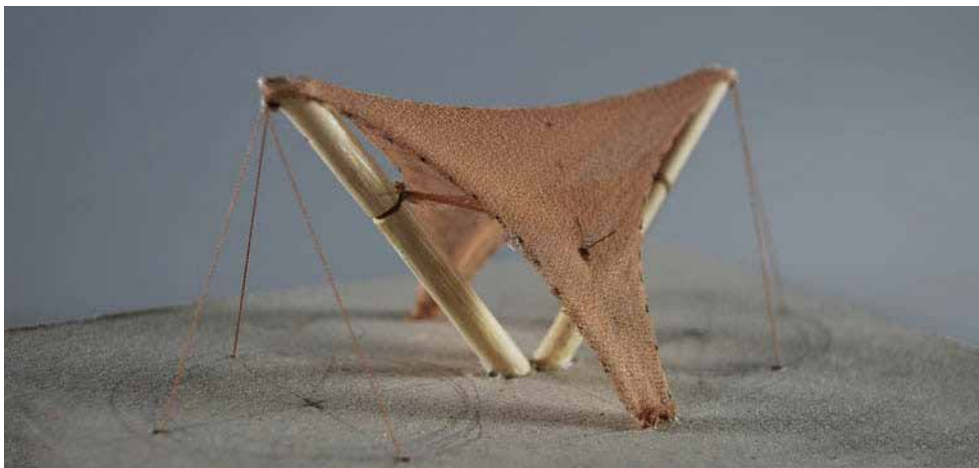


**Spatial containment within separate structural elements:** The first method for subdividing space came from using structural elements to define areas. By pulling two different tensile elements off one supporting pole, each side balancing the tension in the other, two separate spaces are created (**Left**). Each space is complete in its own right, but both also combine to express a wholeness of overall form. The openness of movement between the tensile cables contrasts with the containment of the taut skin's surface - revealing juxtaposing spatial qualities within the same cone form.

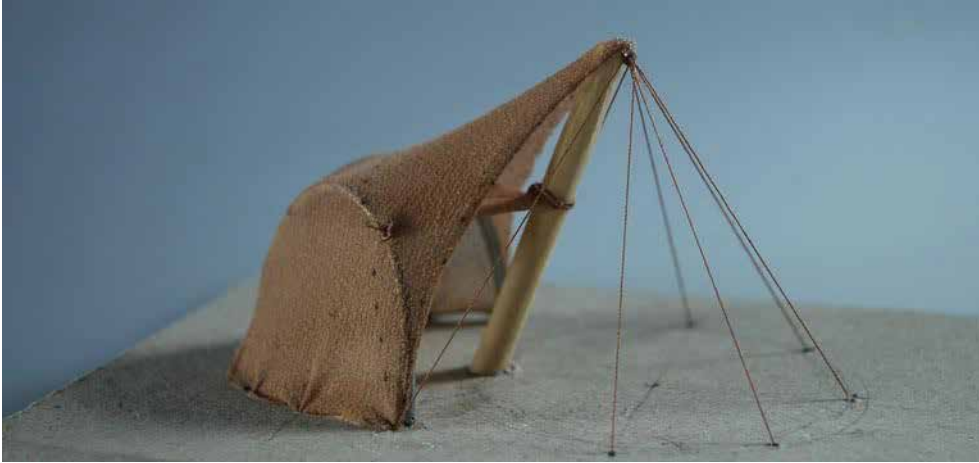


**Spatial containment within spatial containment:** Rather than dissecting one volume into parts, whole parts can inhabit larger whole parts - like building a tent within a tent (Left). This method of spatial separation brings the external form of a tent within the internal form of another and emphasises the connection and flow between the tent's inside and outside.

**Structural nodes as spatial points of reference:** Using the spatial presence of the pole which supports the skin as a point of reference, space can be defined within proximity of where the pole is located (Below left and right). This creates intersecting circular spaces which are contained by imagined rather than physical boundaries, and would be most successful when definition was reinforced by changes in the flooring level or material.



## [ DESIGN ITERATIONS 1. ]



Separating space by contrasting hoop and pole support: A pole is straight whereas a hoop is curved, and these contrasting geometries can be used to define separate spaces (Left and below). Where a pole extends upward to give a sense of extension, a hoop encloses and contains internal space. In this way space created by pole support is more open and public, and can connect the inside to outside, whereas hoops create space that is more secluded and private - thus using hoops to look *inward* and poles to look *outward*.

In these models a pole is grounded in the centre of the form, leaning forwards and steadied by cables to create an open transition of flowing space. this contrasts with the back half of the model where the skin hugs over arched hoops, instead enclosing space.





**An upper hammock level to provide vertical spatial separation:** The earlier question *'can a tent have more than one level?'* led to imagining how tensile structure could satisfy this. The use of a hammock to create an upper level would provide separation and new space within the vertical height of the tent (Above left). To not unduly place a sense of weight overhead and to maintain spatial awareness of the whole, the use of a fabric floor would only cover a partial area of the tent's height to reveal a view through the full height elsewhere. This type of space, for reasons of the difficulty of standing on such an elastic surface, would be suitable for sitting or sleeping, and while it would not necessarily give acoustic separation, it would still provide visual privacy.

**Creating additional space in exterior surfaces:** Rather than designating the surfaces of the tent as either strictly 'inside' or 'outside', fabric walls can be pushed and pulled so that a surface can be simultaneously 'inside' and 'outside' (Above right and following page). Thus external surfaces can shift to provide contained internal spaces; the fabric inhabited on each side and curved to create opposing spatial qualities - but with both sides yet responsive to what happens on the other. The dialogue between what is perceived as 'inside' and what is 'outside' is full of rich potential to explore the permeable qualities of fabric, and does so with greater meaning than the use of fabric to simply create hanging walls subdividing inside the tent that are internal on both sides.



## [ DESIGN ITERATIONS 1. ]



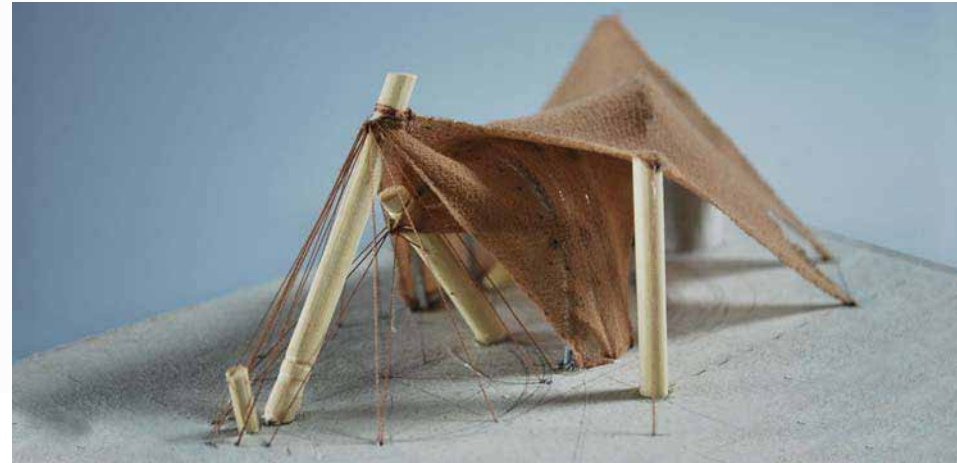
**Multiple skins to contain layers of spaces:** The layer of protection that a tent-fly gives a tent serves to increase the potential level of privacy and also provides an opportunity to inhabit the space between layers ([Below right and opposite page](#)). This method of making space gives the design an outer layer that shelters the inside-outside transition and a linear form that extends to connect out into the landscape.

[ The problem of how to include ablutions sat uneasily since the beginning of the idea of a tent-home - venting steam, smells and preventing mould. An outer layer allows these functions to be brought outside the tent as a separate structure that is still within sheltered proximity under this outer layer ([Sketch on opposite page](#)). ]





Placement of shower and toilet outside main tent  
(two triangles at back) under the outer skin.



## Conclusions

By looking to the structural nature of the 'skin tent' a number of ways to create spatial separation were found that maintained the unified form of the tent without subdividing it as a whole cut into smaller parts. These spatial separations were primarily of the consideration of areas of either *public* or *private* use, rather than of specific 'rooms' that they would fulfil. This approach allowed the form to develop [ on a theme ] with greater attention given to overall shape rather than solely the meeting functional requirements.

The small scale that these models were made on [ 1:100 approximately ] allowed a number of ideas to be realised quickly, without getting slowed by representation. The draw-back however was the limited ability to communicate interior space. The small scale also meant that the texture of fabric was missing. By not being able to represent fabric, an element intrinsic to the essence of the tent was not present.

The next section resumes research by looking to details of fabric construction.



## FABRIC CONSTRUCTION

The possibilities of fabric are the vocabulary of the dressmaker. Garment construction uses a variety of techniques to fit fabric to a form, and to do so without constricting movement. These techniques give three-dimensional volume to a two-dimensional material, and also create great beauty. The relevance of these techniques to tent making being of both construction methods and of surface finishes.

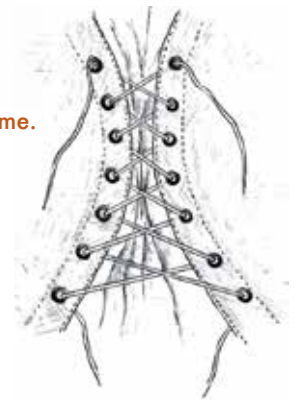
### Glossary of terms<sup>43</sup>

<b>Dart</b>	Folds sewn into fabric to contain excess fabric and fit a curved surface.
<b>Flare</b>	Spreads out or widens an edge.
<b>Gather</b>	A technique for shortening fabric and for creating ruffles.
<b>Godet</b>	An extra piece of fabric, in the shape of a circle sector, sewn into a seam to add volume.
<b>Gore</b>	A curved segment which when sewn onto another creates a 3-D volume, such as in a ball.
<b>Gusset</b>	An extra piece of fabric set into a seam, thus giving added volume.
<b>Join</b>	Stitched seams of many varieties, zippers, buttons, domes, lacing, velcro.
<b>Patch</b>	A piece of fabric used as decoration or to mend or to reinforce.
<b>Pleat</b>	Fabric folded like a concertina, to shorten fabric and provide fullness. Similar to gather.
<b>Vent</b>	A slit or opening that allows ease or movement by opening up.



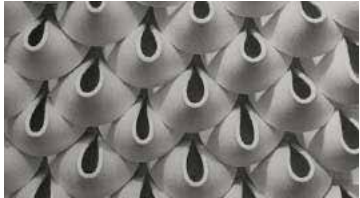
A flare gusset increases volume.

Lacing ties and constricts volume.



43. Definitions are paraphrased from: Carbone, Linda. *Dictionary of sewing terminology*. New York: Arco Publishing Company, 1977.

## Precedents



**Anne Kyyro Quinn:** Felt is the matted woollen fabric that was originally used in covering the yurt, but textile designer Anne Kyyro Quinn uses this material with entirely new interpretation and application. She uses cut layers, pleats and loops to create three-dimensional surfaces, beautiful in appearance and with functional benefits. The tiny cavities in the manipulated fabric surface dampen sound and also provide thermal insulation. These surfaces appeal not only to the eye and to the hand, but also to functional performance.



**Reiko Sudo:** Another textile designer, Reiko Sudo, develops new materials and new processes that expand the realm of fabric properties and applications. She uses micro-fibre metal threads to create flexible but incredibly strong cloths that redefine our expectations of the strength of fabric. She also uses origami to pleat surfaces so that they attain strength in a similar manner to how corrugated iron works, and so that they can compress and expand in an ordered way. Her work transforms the possibilities of fabrics and how we may use them.

## Conclusions

Looking at methods of fabric construction discloses processes of how a tent is built. These methods allow a three-dimensional form to emerge from a two-dimensional sheet, in a way that is integral to tensile construction. Techniques described here fit contours, such as the 'dart' and 'gore'. They give or reduce fullness, such as the 'gather' or 'pleat'. They allow movement, such as the 'flare', 'godet' or 'gusset'. They strengthen the fabric, by reinforcing with 'patches'. And they join with a range of different fixed or opening connections. These are the techniques that will allow not only allow the creation of curvaceous forms, but also reveal details that are beautiful and are the 'essence of the tent'.

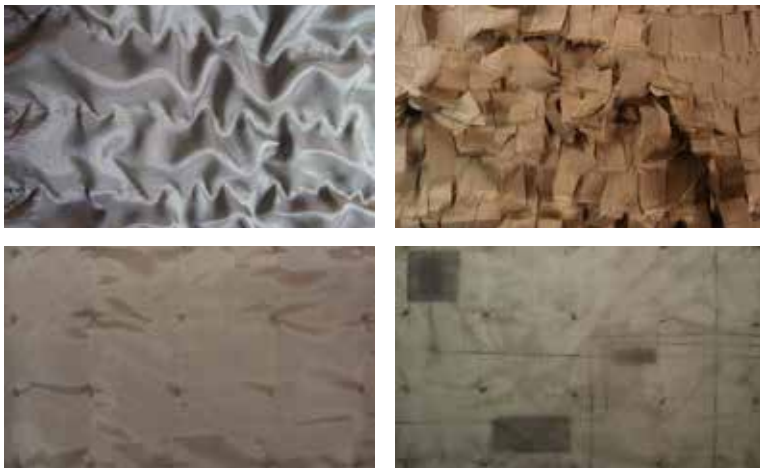
From the precedents recognised, literal applications of ideas may be taken. Surfaces similar to those created by Kyyro Quinn can re-introduce tactile beauty back into the tent, while also providing privacy, intimate acoustics and comfort. And Sudo's material developments can inform fabrics that provide security; their metal compositions still soft, but difficult to cut. However, more than literal application, the greater lesson that the precedents teach is of taking traditional methods, and reinterpreting them in light of new technology and use - this inspiration allowing the tent to be reshaped anew into contemporary culture.

## DESIGN ITERATIONS 2.

The techniques of garment construction gave texture to the forms explored on a miniature scale in the previous design iteration. They allowed covers to be fit, and the provision of greater comfort for the user. The next models were made larger [ 1:50 scale ], and focused more on surface finishes than form, especially of the interior space, so that we could begin to inhabit the design.

As well as the previous fabric construction research section, the earlier exploration of the 'essence of the tent' became relevant in terms of finishes that could be applied to the design - as surfaces that allowed movement, were moved, and that changed with different lighting.

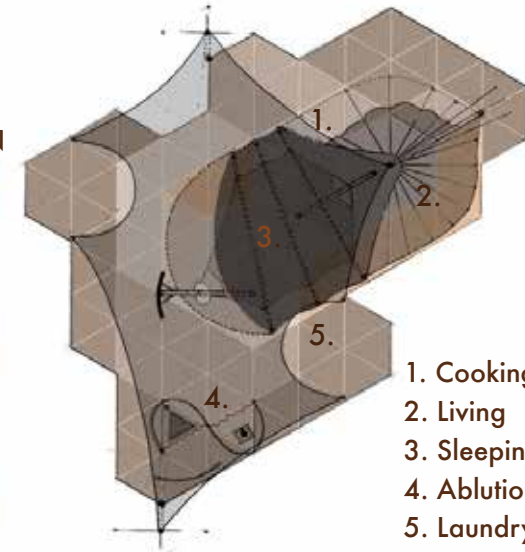
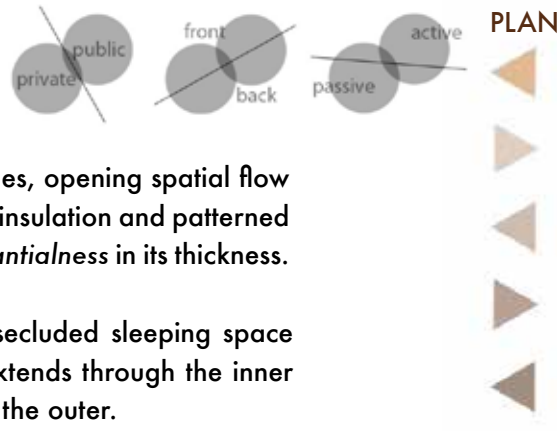
[ Used as an outer skin, a shade-cloth such as 'Ultra-Block' would be suitable as a permeable but still sheltering layer. To satisfy waterproofness the inner cover could be canvas or P.V.C. The lifting portion at the front would benefit from the flexibility of a marine fabric such as 'Top-Gun' [ See appendix 2. ]. Inside the tent, fabrics could be of many types - cotton, silk, wool or whatever the user chose - providing insulation, comfort and beauty. ]



Earlier marquettes exploring qualities of 'the essence of the tent'.



(Right) The triangular flooring pallets that came as a response to an earlier design question are used here, with different surfaces and changes in level indicating spatial zoning

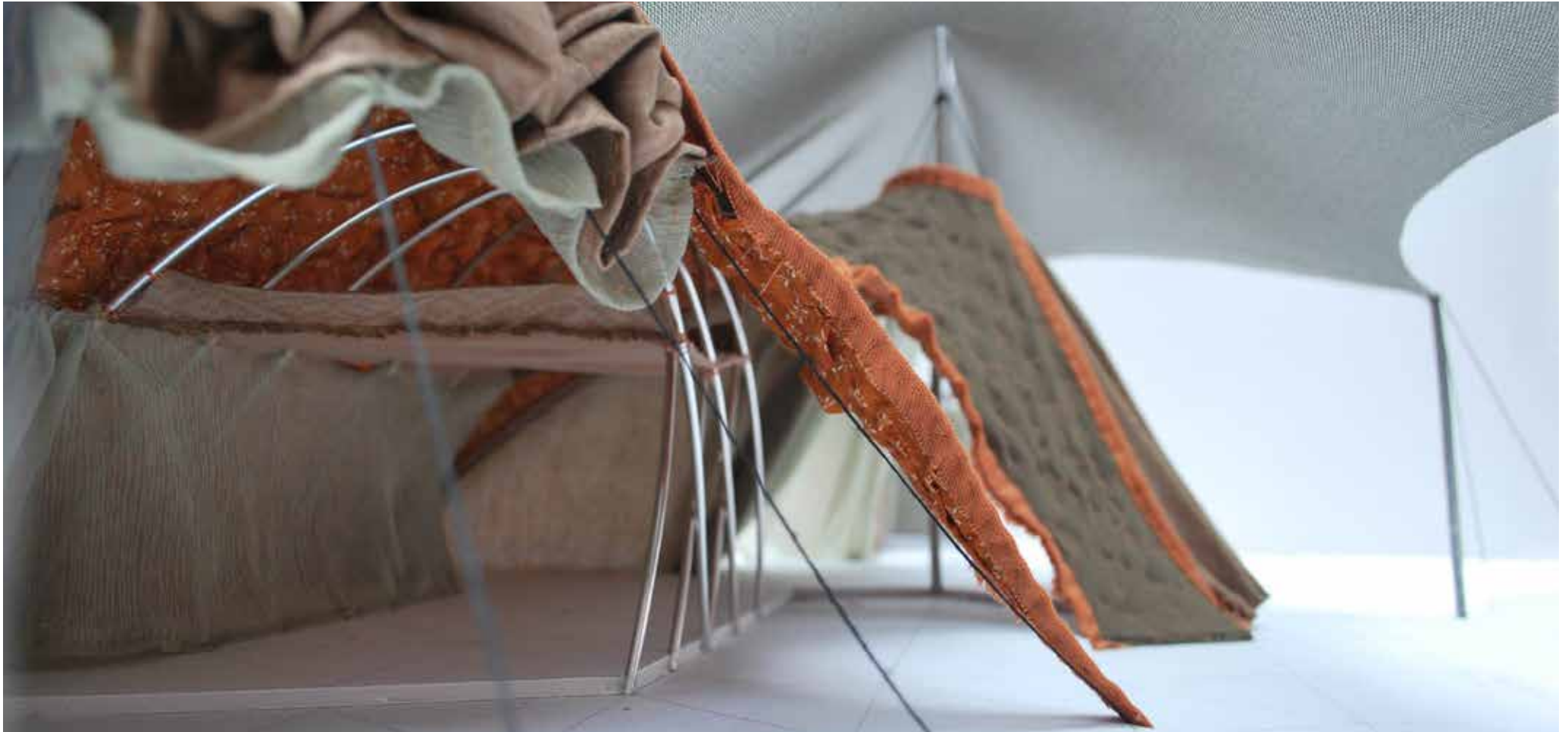


1. Cooking
2. Living
3. Sleeping hammock
4. Ablutions
5. Laundry

(Opposite page right) The front ruffles as it is drawn up upon cables, opening spatial flow from the inside through to the outside. The back cover is quilted for insulation and patterned on the inside, providing tactile texture and a greater sense of *substantialness* in its thickness.

(Below right) A hammock hung between the hoops provides a secluded sleeping space which is reached by a ladder up the back pole. The pole then extends through the inner cover to support the outer cover, connecting the inside space with the outer.







With slight design modifications, the scale of modelling increased [ to 1:20 ] to include more detail, with the intention of having greater ability to recognise the quality of internal space.

**(Left)** Hoops cross in a manner similar to the lattice construction of a yurt wall, and can be used as a ladder to climb into a hammock hung underneath them. The inside of the cover is quilted to provide insulation, and an additional curtain under the hammock contains storage space.

**(Right)** The back pole passes through a ring that the inner cover hangs from, to support the outer canopy. It is topped by a curved 'T' that spreads support in a gentle arch, rather than a point.

**(Below)** The ablutions are situated in a separate structure located under the outer canopy. An 'S' curved trellis wall contains a composting toilet and a shower. [ Further detail in next pages ]





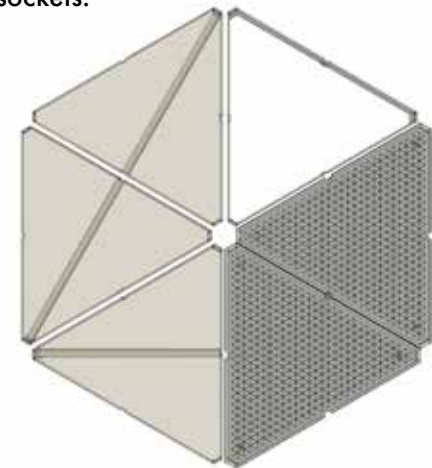
## Modular flooring system

The earlier idea to include services and insulation in a modular floor pallet, was developed concurrently alongside these models of overall form and fabric details. These pallets served to house plumbing and electrical services, to insulate from the ground, to connect poles and pegs, and to be rearranged for different spatial configurations.

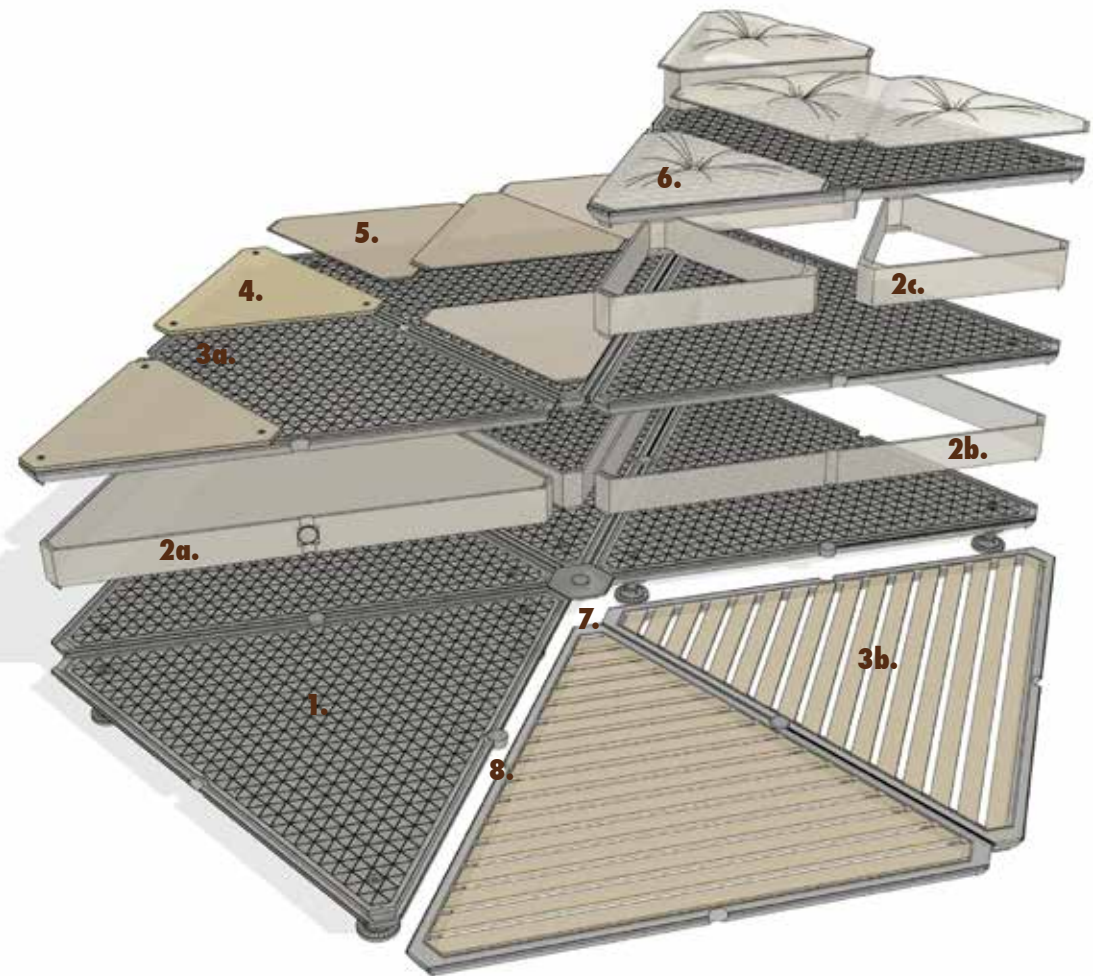
The basic kit of parts consists of a base pallet with a foot on each corner, a wall section that is insulated and has a tube for services to pass through, and a top pallet on which flooring surfaces can be optionally applied. The modules connect together at their three corners by tabs that fit recesses in the module below.



(Below) Services pass through a pipe running within the Primary wall module, the orientation of the pallet rotated to route these. Plugs with specialised connections fit electrical and water-pipe sockets.



- 1.** Primary floor module [ 1500 x 150 mm ]  
Plastic moulded construction. Legs screw down to adjust height.
- 2a.** Primary wall module [ 1500 x 120 mm ]  
Plastic moulded construction. Incorporates a pipe for services and insulation.
- 2b.** Secondary wall module [ 1500 x 120 mm ]  
Frame without insulation. Cavity can be used for storage.
- 2c.** Tertiary wall module [ 650 x 120 mm ]  
Frame without insulation. Can be used under any of the tops.
- 3a.** Primary floor top [ 1500 x 75 mm ]  
As ground module but without legs.
- 3b.** Frame top with timber plank inset [ 1500 x 75 mm ].  
For use as decking, and can also be used as a shower floor.
- 4.** Cork tile top [ 650 x 8 mm ]
- 5.** Carpet tile top [ 650 x 5 mm ]
- 6.** Cushion tile top [ 650 x 55 mm ]
- 7.** Pallet connection piece [ 170 x 20 mm ]  
Six-way dove-tail connector holds the pallets from spreading apart.
- 8.** Plug [ 50 x 25 mm ]  
Three types: Electric socket, water hose connection & basic fill plug.



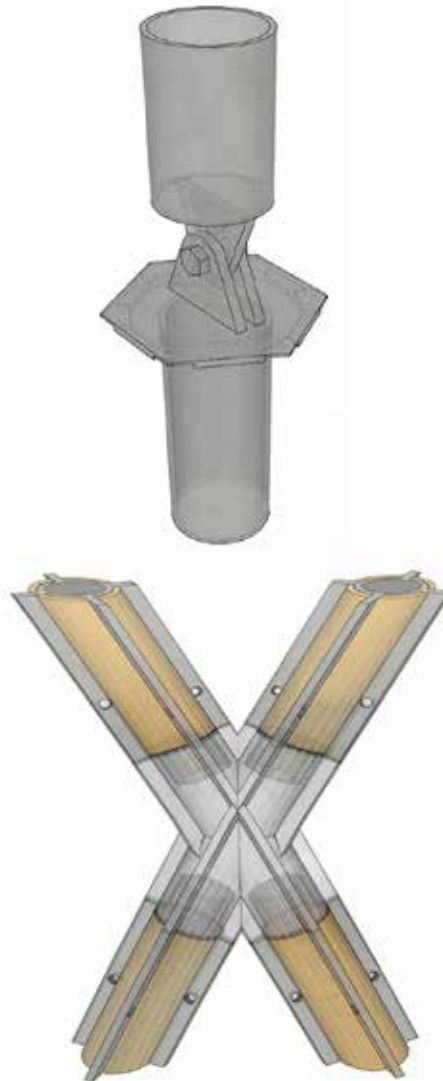
## [ DESIGN ITERATIONS 2. ]

## Details

(Right) The angled front pole has a pin-connection at its base, the height of it then steadied by guy-lines and tension in the skin. The lower part shown slides over a peg driven into the ground to locate it.

(Below middle) The connections of the hoop's crossings is modeled on the sleeve design of camping-tent poles.

(Below) The front pole is a steel circular hollow section, with cruciform flanges. Electric cabling can run through the centre. The flanges have holes every 500 mm which are useful points of connection. Timber slats clad in quarters.

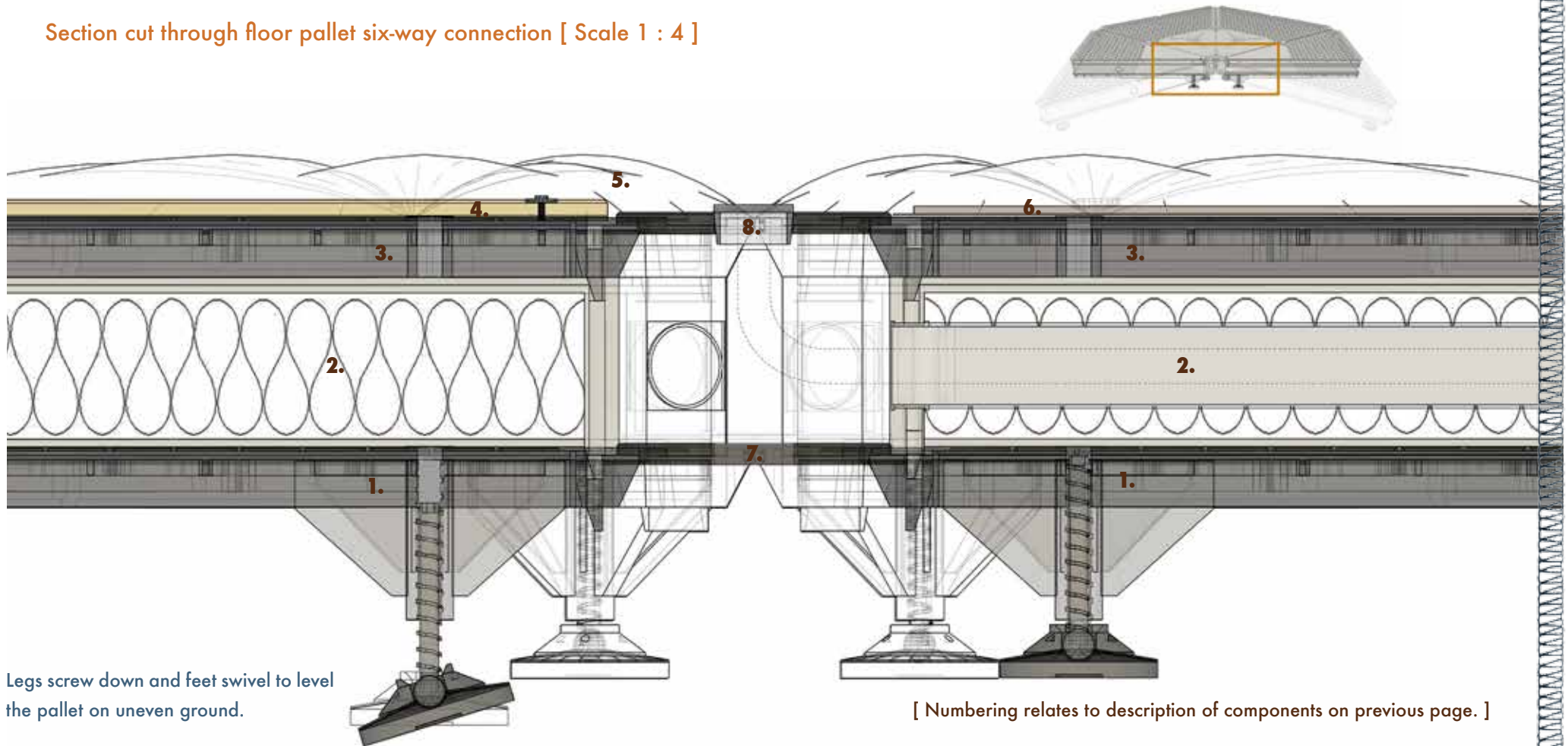


(Below) The ablutions are a basic unit that can be located as the user chooses within the bounds of the outer canopy. For the shower, a specialised wall module collects and directs water, and the floor is the same timber decking module as used elsewhere in the flooring layout. The toilet is a composting type, where the collected matter is mechanically transferred by a rotating drum to a separate decomposing bin [ such as the New Zealand designed 'Kapapo' brand ].





Section cut through floor pallet six-way connection [ Scale 1 : 4 ]





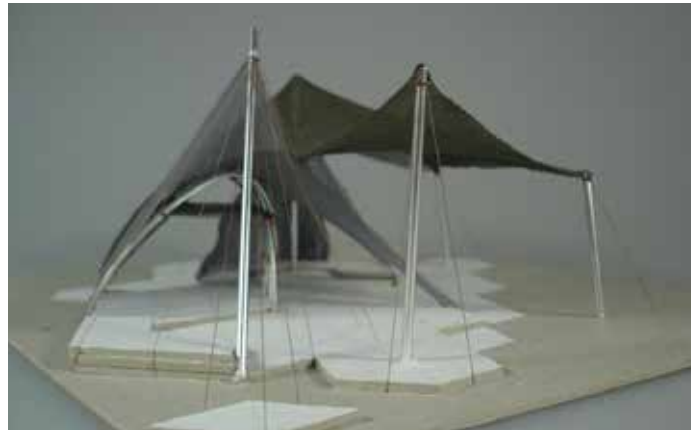
## Conclusions

The increased scale of the last models allowed a more realistic representation which was useful in expressing the specific details of surfaces and of how fabric could provide for domestic needs. Fabric was used to furnish surfaces with texture, to create spatial separation that was still unified, to insulate and to give greater substantialness and sense of security to the weight of the tent. However, magnification also made issues of overall form apparent that were not seen at the smaller scale of modelling.

Through showing greater detail it was revealed that the intention to create a form which connected with flowing space to *belong* within a landscape had not yet been captured. While the addition of an outer layer had aimed to address this by widening the transition between inside and outside, and by giving linear extension to overall form, the presence of this layer as a single thickness of shade cloth mesh instead appeared disconnected from the form below it. The outer skin was like an awning tacked on and it floated weightlessly above rather than communicating any reference of a 'landform' or of seamlessly flowing space. To reconnect with the landscape I trialed pinning it down to the ground at one edge ([Opposite page](#)), but this did not greatly improve spatial flow, and neither did it improve realisation of layers of fabric creating layers of space.

Another issue that came apparent was that the form had gained a static and predetermined appearance. As the viewer's imagination was no longer asked to fill in the blanks, there was less room for recognising the intangible sense of *change* and *movement* which are at the heart of the 'essence of the tent', and this was a problem because if these qualities were not expressed at model scale, they would not be present at full-size either.

The outer cover is pinned back to the ground in an attempt to give the form greater connection to the landscape.



Finally, although it was always expected that a tent would always test conventions of a home, this design did not capture the cues that make a home feel 'homely' or that make it even recognisable. Although I had indeed set about designing a tent, this was *such a tent*. The design contained too many references to associations that come from the modern tent, rather than those of a home. It felt *too temporary*, its form was unfamiliar and perhaps too curvaceous with too few linear elements, and thus the intention of making a shelter that read as a *home* had not been achieved yet.

So I returned to contemplating the qualities of domestic space, of how to achieve a smooth landscape connection and the spatial language of lines and curves. Gaston Bachelard said a pitched roof is shelter, that we understand its angle<sup>44</sup>, and so I looked to the ridge tent as a mirror of this shape, this time focusing on the rectilinear aspects of its form, and in this I realised something very important. I realised that the link between the home and the tent already has a literal manifestation, that being in the form of the *veranda*. Once I began to explore this I saw that I was not the only one to note this, and that the veranda indeed takes *direct* reference to the tent.

The next section looks the veranda for inspiration.



Ridge tent.

<sup>44</sup>. Bachelard, Gaston. *The poetics of space*. Massachusetts: Beacon Press, 1958: p. 18.



## VERANDA



The curve of this veranda references hung fabric and tent construction.

The veranda is a canopy that shelters the edge of a house, providing a wide transition between inside and outside. Its popular use is connected to colonisation, being widely used and dispersed during this time. And while its construction is now of solid materials, it has real ties to the fabric construction of the tent. Early verandas were fabric awnings, coming out of 'canvas-town' origins, and their drape is still sometimes remembered in verandas built in the present day.

Philip Drew<sup>45</sup> has written specifically about the link between the tent and the veranda, both of the replication of the appearance of its original fabric construction and of its unique spatial quality. He describes the veranda as having two distinct spatial aspects. On one side it is enclosed and protected as it attaches to the house, and on the other side it is open, flowing into the surrounds. One side offers *protection* and the other offers *connection*. Between these contrasting qualities of space, Drew describes that the whole shelter has horizontal emphasis, both along its length, and as it connects with a view into the landscape.

Within the form of the veranda sits a demonstration of qualities that are linked to both the tent and to the home. The veranda satisfies the domestic expectations of security by providing a protected edge against which to lean, giving privacy and enclosure. This edge also serves to root the form to the ground and give it a sense of territorial belonging. But in an opposite way the veranda also offers an openness that extends to connect both its form and its spatial quality into the surrounding context, bringing an awareness of the outside into the inside. The veranda is an artifact of a recognisable domestic form, and yet it comes from tented origins.

45. Drew, Philip. *Veranda: Embracing place*. Australia: Angus & Robertson, 1992. [This is yet another time that text by Drew has entered this thesis] Drew repeatedly states in this text that the veranda is Australia's architectural identity. Perhaps in this we gain a clearer understanding of why mainly Australian architects filled the section of this thesis that described the tent's 'spatial essence'.

*'As for verandas. Well, their evocation of the raised tent flaps gives them away completely. They are a formal confession that you are just one step away from the nomads'* <sup>46</sup>

## Conclusions

The veranda demonstrates attributes that are directly linked to questions raised by the use of a tent as a domestic shelter. It is relevant in its spatial quality by revealing how a tent may fit the homely requirements of 'protection' and 'security', and it is relevant in its form by showing how through horizontal extension the tent can integrate into a landscape. By demonstrating a unified meeting of the divergent qualities of *protection* and *connection*, the veranda provides insight into how a tent may also satisfy these aspects.

Through replicating the veranda's grounded back edge, the design gains a method to create sense of stability and substantialness, and it allows the tent to achieve a greater sense of territorial belonging - balancing the contrariness of its transportable nature. Through the veranda's open front and spatial flow, the design is confirmed of earlier research into curved and linear geometries where it was seen that horizontal emphasis extends and connects into the landscape. And ultimately, as part of a home already, the veranda offers potential to inform a design that is recognisably domestic, through reference to the familiar shape of an elongated ridge-line.

The veranda contains the lesson that allows the design to fulfil a reading of 'home', but while still remaining true to the nature of the tent.

*'... outdoor places of leisure should be closed on at least one side to protect from the wind, to provide privacy and to satisfy the human need to lean'* <sup>47</sup>

46. David Malouf quoted in: Drew, Philip. *Veranda: Embracing place*. Australia: Angus & Robertson, 1992: p. 5.

47. Petschek, Peter & Siegfried Gass. *Constructing shadows: Pergolas, pavilions, tents, cables and plants*. Basel: Birkhauser, 2011: p. 23.

## DESIGN ITERATIONS 3.

The lesson of the veranda led the design to take on a very different form from the previous explorations. Instead of rounded volumes, the spatial arrangement became much more linear, and the vertical emphasis of the poles was balanced with horizontal emphasis in plan. Where the vertical emphasis in prior models had come from trying to create the lofty appearance of *floating*, the new designs reduced height and *tethered* the tent back to the ground.



Sketch plan of trellis within tent.



(Opposite page) Interpreting the form of the veranda as an open front and a closed back, and relating it to the form of the ridge tent, many variations could be made in supporting structure as either hoops or poles. A trellis wall - similar to that of a yurt - wraps around one of the main internal poles to separate space. This could be placed in infinite other configurations as the user chose, and in this layout could contain ablutions in the smaller circles (Sketch plan).

(Below left) The cover is separated from the front poles by rope extensions, lessening the finality of the edge, the poles repeating the linear rhythm of veranda posts. A curtain attached to the underside of the cover could be bundled up to maximise inside-outside flow or drop down at night to enclose internal space.

(Below middle) Using principles similar to the tension-band of the traditional yurt, a web of ropes create an upper level within the larger circle of the trellis wall, accessed by climbing up a ladder on the main pole. This space could be used for sleeping or as a general secluded area.

(Below right) To create more space at the back, guy-lines pull the cover out. This also heightens the tent's sense of connection to the ground.



### [ DESIGN ITERATIONS 3. ]

As a variation on the previous model, this model replaces the two main supporting poles with a row of poles that run its length, emphasising horizontal flow in this direction and demarcating the front half of the tent from the back. Cantilevered crossbeams connected to the poles remove the need for a second set of uprights along the front edge, fully opening up spatial flow from inside to outside here.

(Below left and right) The tent's skin is pulled down beyond the ends of the crossbeams, and in doing so the thinness of the fabric's edge is not immediately revealed and volume is contained within the roof cavity. This gives the tent greater visual weight and sense of substantialness, and improves its ability to express the *strength* and *security* that are expected of a home. A hammock, hung between the crossbeams, creates a secluded area within the volume of the roof.

(Opposite page) To give the tent a sense of movement its poles vary in their heights and in their distances apart, and also the horizontal beams vary in length with undulating rhythm. While there are many curved surfaces in the skin of this model, it still presents a much more linear form than the previous models due to its sharp peaks and the 90-degree angles of its 't' poles.





[ The same triangular flooring modules described earlier in this thesis are used here - and in the following design iterations - stepping up levels and changing surfaces to suggest spatial usage and the transition between inside and outside. ]

[ A curtain attached to the underside of the cover - like in the previous model and also suggested in those following - could be tied up or hang to enclose space. ]





### [ DESIGN ITERATIONS 3. ]

The row of poles in the previous model had come from referencing the posts along the front of a veranda, however - while set in a straight line - they proved to express a greater sense of vertical height rather than of horizontal alignment or extension. Remembering the importance of the ridge-line as a recognisable form of domestic construction, the design shifted to the use of a hoop as primary support, the hoop tracing a clearer horizontal line along the length of the tent and replicating the sharp edge that defines the two sides of a pitched roof.



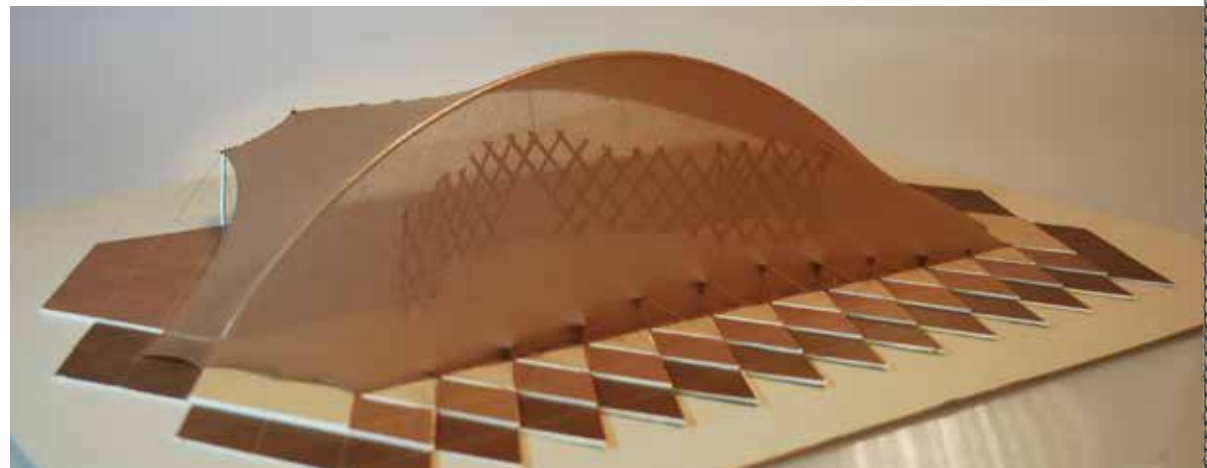
The continuous shape of the single hoop revealed a form that was more unified and complete than the points of localised support created by poles, so that the design gained a greater sense of wholeness. The hoop's curve met more sensitively with the soft form of fabric as the fabric *wrapped* over it and *stretched* from it, expressing of qualities of both the 'skin tent' and the 'fame tent' and also harmoniously containing elements of both linearity and circularity.

(Opposite page) The hoop in this model curves to enclose internal space and as it does it provides the spatial qualities of *protection* and *stillness* that are suited to a home. Poles still used along the front edge lift the cover so that both its space and form extend outward. With the use of hoops to contain internal space and poles to extend external space, this design captures the earlier intention to use these geometries to communicate such.

(Below right) The shift between open front space and more secluded back space is traced with clear definition by either side of the hoop. A trellis wall, similar to the one used in the first design of this set of iterations, further divides the front from the back, and this transition is reinforced again by a rise in the floor level. As the trellis wall curves it encircles a small space at its end which could be used for storage or for a toilet.



(Sketch above) The low arching hoop *grounds* the tent. Whereas the use of poles had presented an upright stance that connected the ground to the sky, the hoop connects from ground, up, over and back down to ground again. The curve expresses a sense of being the 'tip of the iceberg', the ground-line reflecting a continuation of it to root the overall form to the site and to give a quality of *belonging* to the tent's otherwise temporary nature.

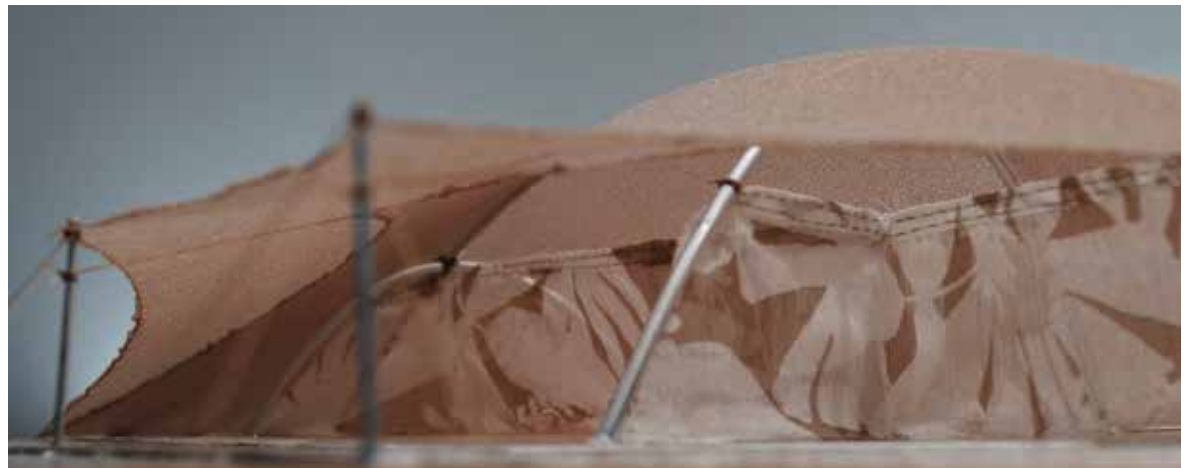


### [ DESIGN ITERATIONS 3. ]

The success in capturing both domestic and tent-like expression through the use of a long low hoop was continued in this model, the length-wise hoop being crossed by two smaller hoops that skewed it width-wise at angles tilted slightly off perpendicular. The addition of these extra hoops divided the space into six potentially separate areas and provided a place to fix curtains - replacing the trellis wall as a way of separating internal space with a way that was more immediately true to the material of fabric.

(Below) Curtains made of a sound absorbent and insulating material such as thick woolen felt would provide privacy but still express fabric permeability in the way that they move in response to activity on the other side. The curtains could be drawn back to open space completely, but to maintain a spatial awareness of the whole while they are closed, they hang *free* from the curved ceiling - allowing a view through the length of the tent that is not obscured or partitioned off.

(Below and opposite page) Double layers of fabric for an outer and an inner skin create an insulating pocket of air and gives *real* thickness and a sense of greater substantial presence to the tent. The layers are staggered to give a gradient to the edge that describes a transition between the inside and outside.



This model begins to capture the qualities of a homely shelter and those of the 'essence of the tent'. It has a sense of *protection* in the enclosed spaces that it provides, and of *stability* in the way that it connects to the ground. And while its form is more simple than earlier design iterations, this simplicity is precisely the factor that lends it a recognisable sense of *familiarity*. The uncluttered beauty of its unified shape furthermore allowing the design to respond to lighting effects and to shift appearance with ease, so that the intangible attributes associated with 'the essence of the tent' come forth.



### [ DESIGN ITERATIONS 3. ]

As a further interpretation of a low length-wise hoop, the next model achieved greater lateral strength by doubling its hoop as a pair, and splaying the two parts at one end to create a wedge-like shape. This asymmetry was matched by the outer skin which - still closed at the back and open at the front - was pinned down at one side and lifted the other, and in doing so gained a protected back corner in which to feel comfortably contained.

(Below right) An inner skin was hung from the underside of the hoops to create a smaller space within the main volume, similar to the earlier method of spatial separation of placing a 'tent within a tent'. The hoops pass between the fabric of this inner layer and the outer skin, and express thickness as described by the depth between surfaces. The hoop is concealed from view behind the inner layer and emerges at the other side to pass unhidden through open space.

(Below) Poles are still used as a part of supporting structure, as a line along the front edge that references the row of posts along the front of a veranda, here their relative distances apart changing with a rhythm that is suggestive of nature of the tent. The presence of the poles along the edge of the tent - rather than placed *central* under the skin - draws out the fabric and provides the least physical and visual obstruction for an open connection and sense of extension.



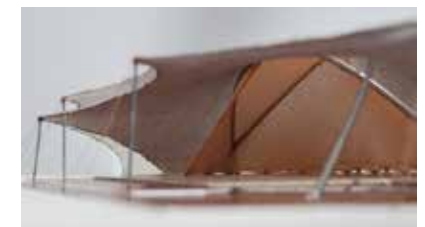
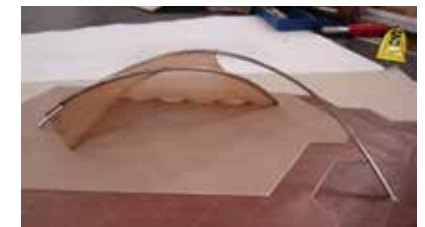
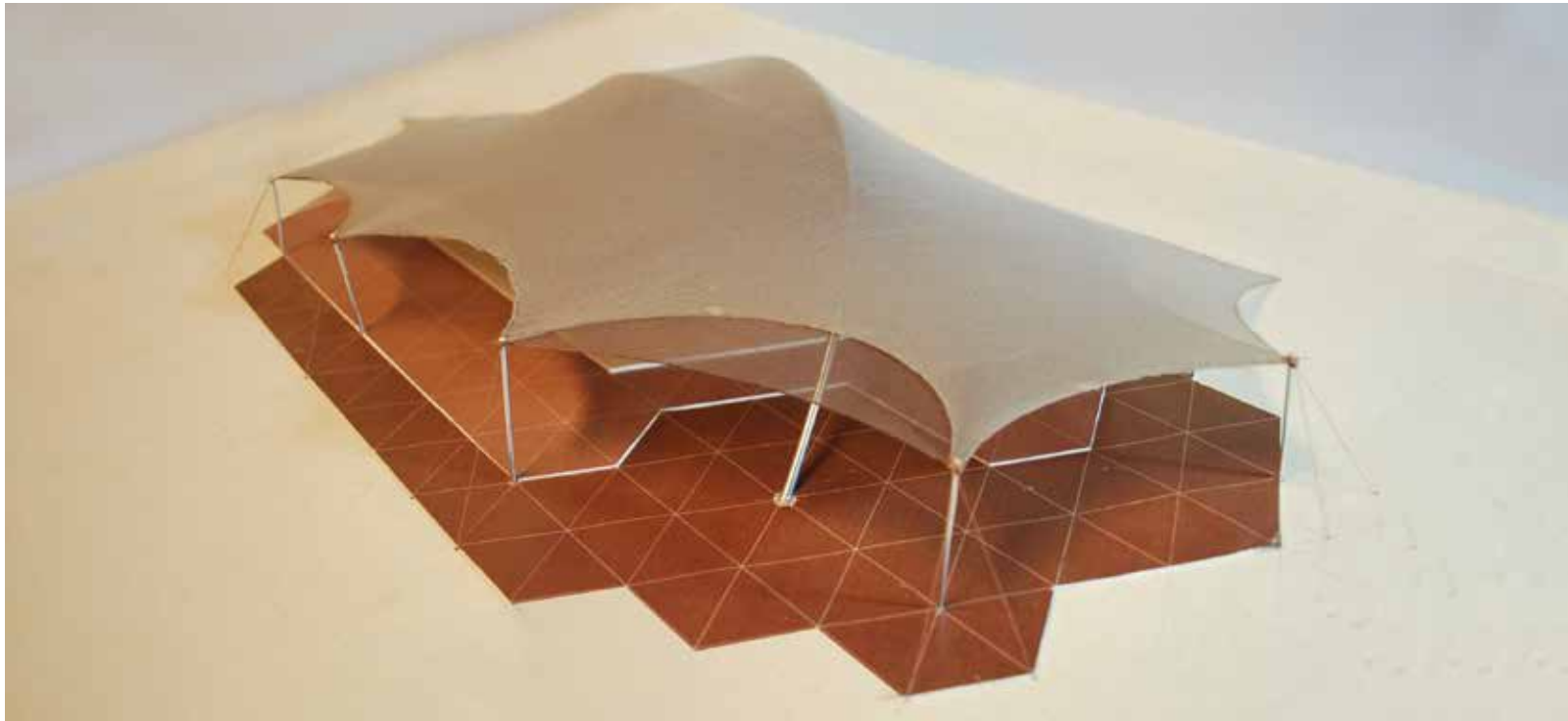


[ The placement of specific spatial functions is less explicit in these iterations than the level at which it was considered in earlier design, the approach instead being for ensuring that areas of general publicness and privacy are contained within each design. As the current design iterations use the triangular floor pallet designed earlier, within which the ability to connect amenities is provided, it is assumed that any specific layout can still be defined as an inhabitant a choose - areas of exposure and enclosure having been considered to meet a range of options. ]



[ DESIGN ITERATIONS 3. ]

(Below right) The last design iteration in this series takes the pair of length-wise hoops from the previous model and leans them outwards in opposite directions and weaves them over one another. This further increases the tent's sense of substantiality by giving thickness not only to layers between the skin, but also as a depth inbetween the supporting hoops. The weaving of the poles references a microscopic view of the construction of fabric and also heightens the sense of the tent's 'essential' quality of dynamic movement.



(Below) Once again the internal skin is stretched from the underside of the hoop, this time creating a triple layered internal area which is able to be zipped closed to contain a private and secure space within the rest of the tent.

The final step of the thesis is based on the models of this last design iteration, as a quarter-size mock-up of truly habitable dimensions.





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[ DESIGN ITERATIONS 3. ]

(Below and opposite) Expressing the tactile aesthetic of tent construction, the skin of the previous models is replaced by real fabric - pinned, tucked, draped and revealing gravity's curve in a way that can only be achieved at a larger scale. The cover is stretched out over a pair of hoops, between poles that hold it aloft at the front, and the ground to which it is pinned at the back. Layers give form, texture, pattern and a sense of substance to the fabric. It is quilted, it has pleated folds and gathers inside which ripple in the wind. It is alive, but it is also soft and comfortable and expressive of the architectural potential of fabric construction.



While this model is made from real fabric and refurnishes the tent with texture, layers that give it thickness and a softness that give it comfort - the ultimate architectural potential of the tent is still within the realm of our imagination. The limits of large-size model-making leave this last exploration without the stability of the smaller models, so that while interior surfaces are expressive, the overall form loses its power to communicate smooth tensile strength. The ultimate outcome of this thesis would capture the smaller model's simple curvaceous tautness of outer form and contrast it with the delicacy of fabric details lining the inside.





## Conclusions

The third iteration of design focused on aspects that make a home recognisable and that satisfy emotional needs by looking to the *veranda* for inspiration. The veranda - relating directly to both domestic space and tent construction - developed the design in a very different direction from that of earlier explorations. Spatial separation became much more subtle and yet it also became clearer; providing *privacy* and *security* in a closed back and *connection* to the surrounds with an open front - definition between front and back proving to be a successful way of creating the variety of spatial qualities expected of a home without disrupting the spatial flow inherent to a tent.

The models emphasised horizontal extension over vertical height, and this led to the use of hoops as primary structural support - over that of poles. Hoops linearly divided space, created the recognisable domestic shape of a pitched roof with two angled sides, and grounded the design against its tendency to have an appearance of disconnected autonomy. The tent became simplified and unified compared to the previous design, and this both satisfied psychological requirements of a home, and captured qualities inherent to 'the essence of the tent'.

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(Left) Model from the third design iteration with main support by hoops.

(Right) Model from the second design iteration with main support by poles.



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## OVERALL DESIGN CONCLUSION

The design process of this thesis has taken inspiration from many sources, and design iterations have explored many different solutions. From initial consideration of qualities intrinsic to the 'essence of the tent', such as *movement, permeability and responsiveness*, to recognition of structure and materials and then to the placement of the function of 'home' and its emotional content of *familiarity, security, comfort and privacy*. The diversity of outcomes presented relate to the number of different factors considered, and describe the intrinsic fluidity of the tent to move and to change in response to a number of factors. Some paths of exploration have been more successful than others, but all have been useful in cultivating an understanding of the tent's beauty and greater architectural potential.

A major premise that shaped design was of the tent's use as a 'home'. This initially came from seeing that the tent lost a great deal of beauty and comfort in its changing function; when provisions for inhabitation were lost to measures of efficiency. The importance of providing for a domestic function was again realised when research into the 'essence of the tent' saw that the tent inherently responds to, and is shaped by its usage. And once more the need to consider use was confirmed in seeing that the transportable and 'site-less' nature of the tent requires the constancy of a specific function to give it meaning. Through defining the design brief as a 'home' - and looking to the personal connections that this provided for - the focus was found that looked beyond the tent's attribute of *efficiency* and developed it to provide personal engagement and an expression of beauty once more.

After a number of design concepts that led from questions raised during research, the design process proceed through model-making - in three iterations.

Initial design was inspired by the structural type of the 'skin tent', seen to contain the greatest expression of qualities unique to fabric construction. This structural basis addressed the question of how to sensitively achieve the spatial separation expected of a home, and resulted in the development of many methods that provided a mix of open, enclosed and adjoining spaces that still maintained the tent's interconnected form. This process looked at the tent from an external view-point, and so to gain a clearer understanding of internal space, of surfaces and of how to meet the needs of its use, the next stage enlarged model-making.

The second design phase looked to methods of garment tailoring to refurnish the tent with texture and comfort, and a flooring system was also developed that contained electrical and plumbing amenities, storage, and insulation. While this section revealed many details of *how* to provide for domestic needs, it also revealed that the form of the design was disjointed and did not yet capture the full potential of either a *tent* or a *home* - and thus required rethinking.

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An early sketch capturing 'essence of a tent' (Left) gains form in a later model (Above).

The third stage of design looked to the example of the *veranda* to develop a form that captured both the *security* of a home and the *openness* of a tent. Reference to the veranda divided space between a closed back and an open front, addressing the desire for privacy while still maintaining a connecting spatial flow within the tent and out into the surrounds. The last models of this design iteration were the most successful, with the delineation between front and back being suggested in the two opposing sides of a pitched roof formed by a low arching hoop. It was in these last models that the design gained; a form that was recognisable to domestic construction - yet still true to fabric structure, definition between public and private areas that didn't simply subdivide space, and a simplicity that allowed the ephemeral qualities of the unique beauty of the tent to come forth.

The three iterations of design explored fabric construction in different ways: In the first iteration, tensile structure created curvaceous forms with beauty in their overall shape. In the second iteration, fabric details and textures refurnished surfaces that had once been left blank. And in the third iteration, fabric contained space in a way that satisfied personal emotional response. - The beauty of fabric construction thus informing from the largest to the smallest elements of design.

[ OVERALL DESIGN CONCLUSION ]



Movement expressed in the final model.

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The focus of this thesis was to reinstate the beauty of the tent, and through considering the functional and emotional factors of its use as a home this was achieved. The design outcome refurnished the tent with the latent beauty of its fabric construction and found an expression of form that could be appreciated for both its simple beauty and for its emotional comfort.

[ The explorative nature of this design project means that it is difficult to find an ending point. Even still I find myself wanting to make more models. Like the evolution of the tent, there is no definitive end point. Design is cyclical, and so I see myself continuing to follow this inspiration.

One potential that I see is that, even if not used as a 'home', some of the later designs could be made as marquees for special events. While it was said earlier that *non-specific* use has stripped the tent's beauty and meaning, the tent is still always adaptable to new uses, and if the consideration of human inhabitation has benefited the tent, perhaps the greatest way it has done so is simply by making it a shelter that can be intimately engaged with, and which is true to the beautiful essence of fabric construction; in form, in texture and in comfort - regardless of use. ]

## THESIS CONCLUSION

### Overview

#### Aim

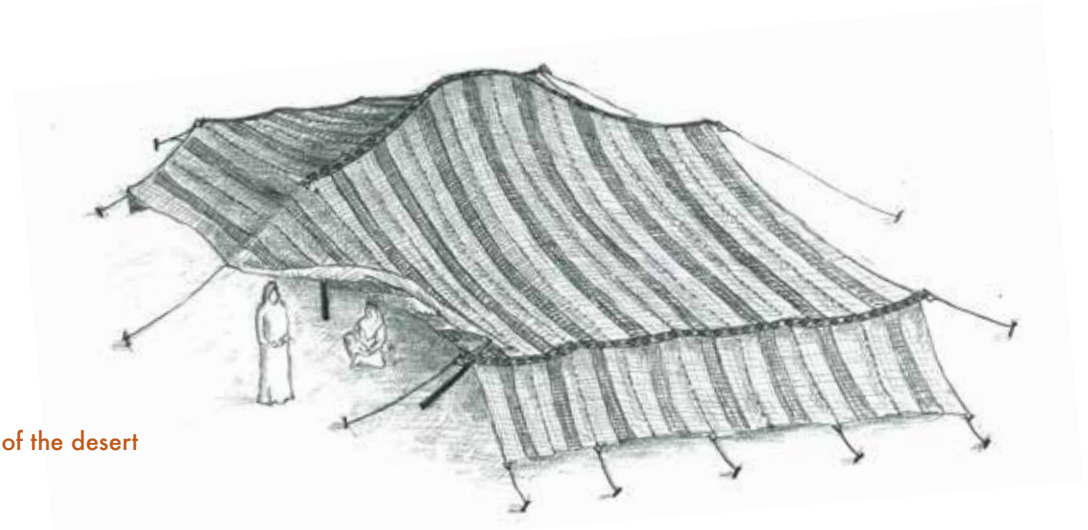
This thesis began with the issue that the modern tent has become a shell of its former self, stripped of its own nature through unbalanced development of its structural attributes of *efficiency* and *practicality*. This came coupled with a realisation that, conversely, the tent has virtues unique to its fabric construction, which offer the inherent potential to provide great *comfort* and *beauty*. The architectural validity of the tent was tested against the theories of Marcus Vitruvius and Gottfried Semper, with the finding that by reconsidering a more intimate use of the tent, the beauty and meaning of its fabric skin would come forth. Thus the direction was formed of refurnishing the tent with the function of 'home' - and considering how fabric could satisfy the details that ensued - so as to meet the thesis aim of restoring an architectural appreciation of *beauty* and *personal comfort* back into the tent.

#### Research

A wide scope of research was undertaken in gaining an understanding of different aspects of the tent. Investigations looked to traditional and contemporary forms, recognising changes in materials, structure and scale. Areas influenced by the tent were researched; such as tensile structure and modular construction, the use of the tent for spatial and symbolic metaphor, and the modern phenomenon of comfortable 'glamping' camping - all of these influences providing inspiration and technical developments that could feed back into the tent. Further research explored intangible qualities that relate to the 'essence' of the tent's fabric construction, with the discovery of unique characteristics of *movement*, *permeability* and *responsiveness*. The psychological needs provided for by a home were researched for their implication on the intended design and tensile construction and material properties were recognised for the physical practicalities of making such a tent. Later during design, techniques used by dress-makers were understood for the manipulation of fabric surfaces, and the spatial precedent of the veranda was looked to for its ability to connect to the surrounding landscape, while yet satisfying the homely needs of *privacy* and *security*. Much of this research was summarised for the sake of keeping the thesis on track, a wide holistic understanding sought as it was seen that - like its relationship between skin and support - all things in the tent are inter-woven and inter-reliant.

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Traditional 'Black tent' of the desert



## Design

The process of design explored many ideas. With no single location on which this transportable structure is locked to, the function of 'home' was taken as a set of parameters instead. Initial design was based on structural forms, taking special reference to the 'skin tent', which was developed as it contains the most distinct expression of tented spatial 'essence'. Fabric finishes were considered, and the design was given a layer of texture that related more closely to its provisions for inhabitation. The level of detail was magnified, revealing readings of the overall form that were not successful in satisfying psychological requirements of a 'home'. This focused the design toward deeper emotional cues of a home through reference of the form of the *veranda*, this ultimately presenting a solution that expressed both the nature of being a home and of being a tent.

The range of solutions that came from the design exploration all contain different aspects the architectural potential of the tent, with the body of work as a whole presenting the greater outcome, rather than any single form.

## [ THESIS CONCLUSION ]

### Discussion

The tent is not the shelter it once was. It has lost the ability to express beauty and meaning. The outcome of this thesis is a physical description of how, by placing thought for its use at the forefront of design, the tent can become more than its present realisation. This is done through considering the nature of its fabric construction.

Fabric is a material loaded with beauty. It has softness, it has texture and it has warmth. Fabric is inherently comfortable, yet in the modern tent these virtues are not recognised; surfaces have been pared back to become featureless, and the means to provide comfort has been lost. In the modern tent the qualities of fabric that give it its unique spatial essence have been relegated in preference for the efficiencies of lightweight construction. And while these qualities have been explored for their architectural value within more solid areas of construction, in their tented origins they have been all but forgotten. The tent is a shell of its former self. It has lost parts that provide for the deeper comforts that go beyond immediate protection. It has lost aesthetic appreciation and it has lost meaning.

To regain beauty back into the tent, this thesis considers how fabric can fit the requirements of a 'home'. By meeting domestic function, the nonspecific use that stripped beauty from the tent is addressed, and fabric is given a set of parameters that engage directly with the needs of an occupant. This approach realises behaviour and qualities which are unique to fabric, beyond being just a cosmetic embroidery of decoration. Fabric form and details are used to inform the design, to conveying meaning and to satisfy aspects of comfort and privacy that lack in the tent's current manifestation - but which are so required of a personal space. Through considering fabric qualities, the tent shows that it is able to meet domestic expectations, however with new interpretation; its essential attributes of *flexibility*, *permeability* and *responsiveness* bringing an enhanced appreciation of change to the experience felt within the shelter.

By exploring the nature of fabric construction - beyond virtues of its efficiency - the aesthetic and functional potential of the tent are redefined, giving this structure a realisation greater than its current form. Through providing for the needs of inhabitation, the tent gains the intimate engagement of the user, allowing one the ability to appreciate beauty. The feedback loop of this is that, by fitting a specific use, the tent actually gains wider use; by providing a more considered level of shelter the tent gains wider appreciation.

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Design from third iteration.

Vitruvius asked that true architecture provide *strength*, *usefulness* and *beauty*. In the designs explored within this thesis these qualities find realisation; as strength in flexibility, as usefulness in fitting the function of home, and as beauty as inherent to fabric. By looking back to the tent's functional origins, the design changes associations of primitiveness and austerity, to become a shelter of refinement. It surpasses its current definition of 'efficiency' to be shaped by the softer nature of its fabric construction. The models of this design exploration contain the beauty of tented construction, and relate directly to the elusive qualities that make architecture distinct.

The implication of this thesis is the restoration of a construction type that offers opportunities unique from any other form of construction. The tent provides shelter that appreciates fabric as a supple filter which responds, adapts and provides greater awareness - and that also provides comfort. This thesis describes a prototype for a kind of home that has been undeveloped since nomadic society, yet that still has a valid place. And while the tent currently has a reputation for discomfort that stands in the way of realising the immediate adoption of a tented home, this thesis offers a suggestion to realign those views.

This thesis has taken the essential virtues already latent in the tent, it has reawakened them and then it has aligned them with contemporary notions of a home. This has been an exploration of fabric construction towards 'Reinventing the tent'.



## IMAGE CREDITS [ All sketches by author. ]

p. 13.	Modern camping tents.	Modified Photograph. Taken from: <a href="http://www.toxel.com/inspiration/2009/06/10-creative-and-unusual-camping-tents/">http://www.toxel.com/inspiration/2009/06/10-creative-and-unusual-camping-tents/</a> (accessed 25/5/2011)
17-18.	Pegs of a black tent.	Cropped and modified photograph. Taken from: <a href="http://www.sciencephoto.com/media/134470/enlarge">http://www.sciencephoto.com/media/134470/enlarge</a> (accessed 20/3/2012).
19.	Dictionary definition of 'tent'.	Text and drawing. Taken from: <i>Funk and Wagnall's standard desk dictionary</i> , Volume 2 (N – Z). USA: Lippincott & Crowell, 1983 Edition: p. 697.
20.	Nomad's camel and tent package.	Modified Photograph. Taken from: <a href="http://en.wikipedia.org/wiki/File:Nomad_prayer.jpg">http://en.wikipedia.org/wiki/File:Nomad_prayer.jpg</a> (accessed 21/3/2012).
31.	'Wrapped Reichstag', Christo, 1995.	Photograph. Taken from: <a href="http://www.csmonitor.com/The-Culture/The-Home-Forum/2010/0805/Christo-and-the-art-of-the-moment">http://www.csmonitor.com/The-Culture/The-Home-Forum/2010/0805/Christo-and-the-art-of-the-moment</a> (accessed 17/7/2011).
32.	Frame tent.	Photograph. Taken from: <a href="http://pub.mtholyoke.edu/journal/silk/?page=1">http://pub.mtholyoke.edu/journal/silk/?page=1</a> (accessed 19/4/2012).
32.	Skin tent.	Photograph. Taken from: <a href="http://www.gordonclarke.co.uk/news_tents-erection.html">http://www.gordonclarke.co.uk/news_tents-erection.html</a> (accessed 19/4/2012).
33-34.	Desert 'Black tents'.	Cropped and modified photograph. Taken from: <a href="http://www.showplace.com.au">http://www.showplace.com.au</a> (accessed 3/3/2012)
39.	Classical Greek column.	Cropped photograph. Taken from: <a href="http://blog.cleveland.com/pdextra/2008/06/cleveland_museum_of_arts_1916.html">http://blog.cleveland.com/pdextra/2008/06/cleveland_museum_of_arts_1916.html</a> (accessed 20/3/2012).
41.	Woven carpet textile.	Cropped photograph. Taken from: <a href="http://www.richardrothstein.com/hi-res.html?http://site.richardrothstein.com/images/rugs/h/heriz-rug-theri004.jpg">http://www.richardrothstein.com/hi-res.html?http://site.richardrothstein.com/images/rugs/h/heriz-rug-theri004.jpg</a> (accessed 20/3/2012).
45-46.	Fabric texture.	Cropped, modified and overlaid drawing. Main image taken from: <a href="http://korbartwhus.wordpress.com">http://korbartwhus.wordpress.com</a> (accessed 2/3/2011)
48.	Oval pavilion, V. Shuckhov, 1896. [ Figure 1. ]	Cropped photograph. Taken from: <a href="http://en.wikipedia.org/wiki/File:Oval_pavilion_by_Vladimir_Shukhov_1896.jpg">http://en.wikipedia.org/wiki/File:Oval_pavilion_by_Vladimir_Shukhov_1896.jpg</a> (accessed 11/4/2011).
48.	Music pavilion, F. Otto, 1955. [ Figure 2. ]	Photograph. Taken from: <a href="http://karabrodgesell.wordpress.com/2009/08/18/frei-otto/">http://karabrodgesell.wordpress.com/2009/08/18/frei-otto/</a> (accessed 11/4/2011).
48.	German pavilion, F. Otto, 1967. [ Figure 3. ]	Photograph. Taken from: <a href="http://www.arch.mcgill.ca/prof/sijpkes/D+C-winter-2005/pavillions_tensile/Page.htm">http://www.arch.mcgill.ca/prof/sijpkes/D+C-winter-2005/pavillions_tensile/Page.htm</a> (accessed 17/7/2011).
48.	Ingalls Rink, K. Tange, 1958. [ Figure 4. ]	Photograph. Taken from: <a href="http://www.columbia.edu/cu/gsap/BT/DOMES/TIMELN/tkyo_gym/tkyo_gym.html">http://www.columbia.edu/cu/gsap/BT/DOMES/TIMELN/tkyo_gym/tkyo_gym.html</a> (accessed 17/7/2011).
49.	Dymaxion house, B. Fuller, 1941. [ Figure 5. ]	Photograph. Taken from: <a href="http://www.columbia.edu/cu/gsap/BT/DOMES/TIMELN/tkyo_gym/tkyo_gym.html">http://www.columbia.edu/cu/gsap/BT/DOMES/TIMELN/tkyo_gym/tkyo_gym.html</a> (accessed 17/7/2011).
49.	'Biosphere' pavilion, B. Fuller, 1967. [ Figure 6. ]	Photograph. Taken from: <a href="http://www.flickr.com/photos/scottnorsworthy/2290019229/">http://www.flickr.com/photos/scottnorsworthy/2290019229/</a> (accessed 17/7/2011).
50.	Takatori church, S. Ban, 2005. [ Figure 7. ]	Photograph. Taken from: <a href="http://www.skyscrapercity.com/showthread.php?t=471453">http://www.skyscrapercity.com/showthread.php?t=471453</a> (accessed 17/7/2011).
50.	Curtain wall house, S. Ban, 1995. [ Figure 8. ]	Photograph. Taken from: <a href="http://www.aswethinkis.com/2011/10/10/cheeky-architecture/">http://www.aswethinkis.com/2011/10/10/cheeky-architecture/</a> (accessed 17/7/2011).

p. 50.	Japan Pavilion, S. Ban, 2000. [ Figure 9. ]	Photograph. Taken from: <a href="http://kozaimodern.com/shoptalk/?p=370">http://kozaimodern.com/shoptalk/?p=370</a> (accessed 17/7/2011).
51.	Magney House, G. Murcutt, 1984. [ Figure 10. ]	Photograph. Taken from: <a href="http://www.wallpaper.com/gallery/architecture/glenn-murcutt-architect/17050240/13914">http://www.wallpaper.com/gallery/architecture/glenn-murcutt-architect/17050240/13914</a> (accessed 4/4/2011).
52.	Longitude 131, C. Richardson, 2002. [ Figure 11. ]	Photograph. Taken from: <a href="http://glampinggirl.com/listing/longitude-131%C2%B0/">http://glampinggirl.com/listing/longitude-131%C2%B0/</a> (accessed 10/5/2011).
52.	Tent house, G. Poole, 1990. [ Figure 12. ]	Photograph. Taken from: <a href="http://picasaweb.google.com/lh/photo/OyMjdexBnt6Q_iWTcTYPew">http://picasaweb.google.com/lh/photo/OyMjdexBnt6Q_iWTcTYPew</a> (accessed 4/4/2011).
52.	Wall house, Frohn & Rojas, 2007. [ Figure 13. ]	Photograph. Taken from: <a href="http://glampinggirl.com/listing/longitude-131%C2%B0/">http://glampinggirl.com/listing/longitude-131%C2%B0/</a> (accessed 7/4/2011).
53.	'Petrified' tent shaped roof. [ Figure 14. ]	Drawing. Taken from: Drew, Philip. "The petrification of the tent: The phenomenon of tent mimicry." In: <i>Architecture Australia</i> , v. 76, n. 4 (June 1987): p.22.
54.	Tent-inspired decorated bedroom. [ Figure 15. ]	Photograph. Taken from: <a href="http://en.wikipedia.org/wiki/File:Ch%C3%A2teau_de_Malmaison_-_Appartement_de_Jos%C3%A9phine_001.jpg">http://en.wikipedia.org/wiki/File:Ch%C3%A2teau_de_Malmaison_-_Appartement_de_Jos%C3%A9phine_001.jpg</a> (accessed 25/2/2012).
54.	Birthing tent, Dre Wapenaar, 2003. [ Figure 16. ]	Photograph. Taken from: <a href="http://www.flickr.com/photos/hawktrainer/237169840/">http://www.flickr.com/photos/hawktrainer/237169840/</a> (accessed 25/3/2012).
54.	Tree tents, Dre Wapenaar, 2011. [ Figure 17. ]	Photograph. Taken from: <a href="http://www.flickr.com/photos/z33be/5912563576/">http://www.flickr.com/photos/z33be/5912563576/</a> (accessed 25/3/2012).
55.	Glamping tent interior. [ Figure 18. ]	Photograph. Taken from: <a href="http://www.agendacity.com/sydney/things-to-do/paperbark-camp-jervis-bay/">http://www.agendacity.com/sydney/things-to-do/paperbark-camp-jervis-bay/</a> (accessed 25/4/2012).
55.	Glamping tent interior. [ Figure 19. ]	Photograph. Taken from: <a href="https://leggotunglei808.wordpress.com/2011/11/27/">https://leggotunglei808.wordpress.com/2011/11/27/</a> (accessed 25/2/2012).
55.	Glamping tent, Ocean Grove. [ Figure 20. ]	Photograph. Taken from: <a href="http://www.flickr.com/photos/67244935@N02/6125042630/sizes//in/photostream/">http://www.flickr.com/photos/67244935@N02/6125042630/sizes//in/photostream/</a> (accessed 7/5/2011).
58.	'Brick tent', P. Lange, 2011.	Cropped and modified Photograph. Taken from: <a href="http://timespanner.blogspot.co.nz/2011/10/revamping-of-totara-ave-new-lynn.html">http://timespanner.blogspot.co.nz/2011/10/revamping-of-totara-ave-new-lynn.html</a> (accessed 20/4/2012).
69.	Recognisable form of a NZ house.	Photograph. Taken from: <a href="http://www.nzetc.org/tm/scholarly/tei-Arc02_03DesR-t1-body-d4.html">http://www.nzetc.org/tm/scholarly/tei-Arc02_03DesR-t1-body-d4.html</a> (accessed 6/8/2011).
84.	Erecting a Black tent.	Modified Photograph. Taken from: <a href="http://www.impactphotos.com/Preview/PreviewPage.aspx?id=1265158&amp;pricing=true&amp;licenseType=RM">http://www.impactphotos.com/Preview/PreviewPage.aspx?id=1265158&amp;pricing=true&amp;licenseType=RM</a> (accessed 25/3/2012).
86.	Inside a Black tent.	Cropped and modified Photograph. Taken from: <a href="http://urtravelogues.wordpress.com/2012/03/26/standing-on-the-edge-of-the-world/">http://urtravelogues.wordpress.com/2012/03/26/standing-on-the-edge-of-the-world/</a> (accessed 25/3/2012).
94.	Fabric sample, A. Quinn.	Cropped Photograph. Taken from: <a href="http://www.annekyyroquinn.com/">http://www.annekyyroquinn.com/</a> (accessed 25/8/2011).
94.	Fabric sample, R. Sudo.	Cropped photograph. Taken from: <a href="http://www.throughthesurface.com/journal/LM_Dec04.htm">http://www.throughthesurface.com/journal/LM_Dec04.htm</a> (accessed 25/8/2011).
105.	Veranda, Waikuku, 2011.	Photograph. Taken by: author.

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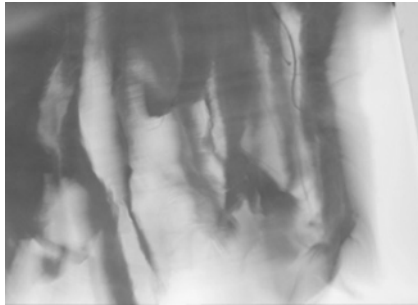
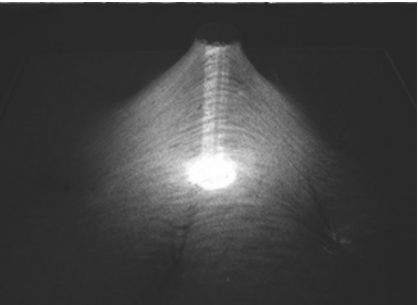
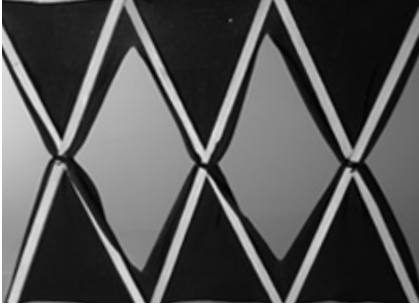
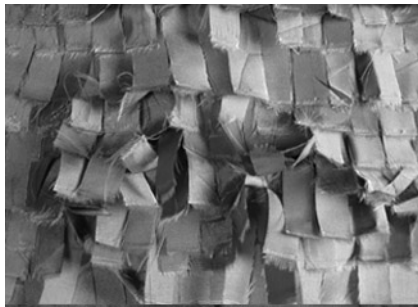
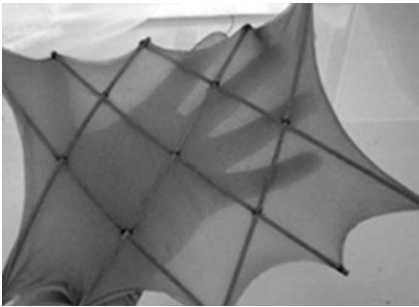
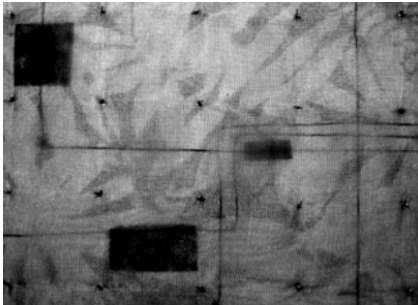
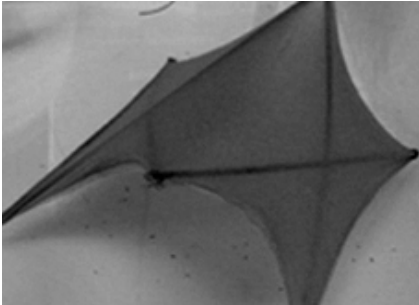
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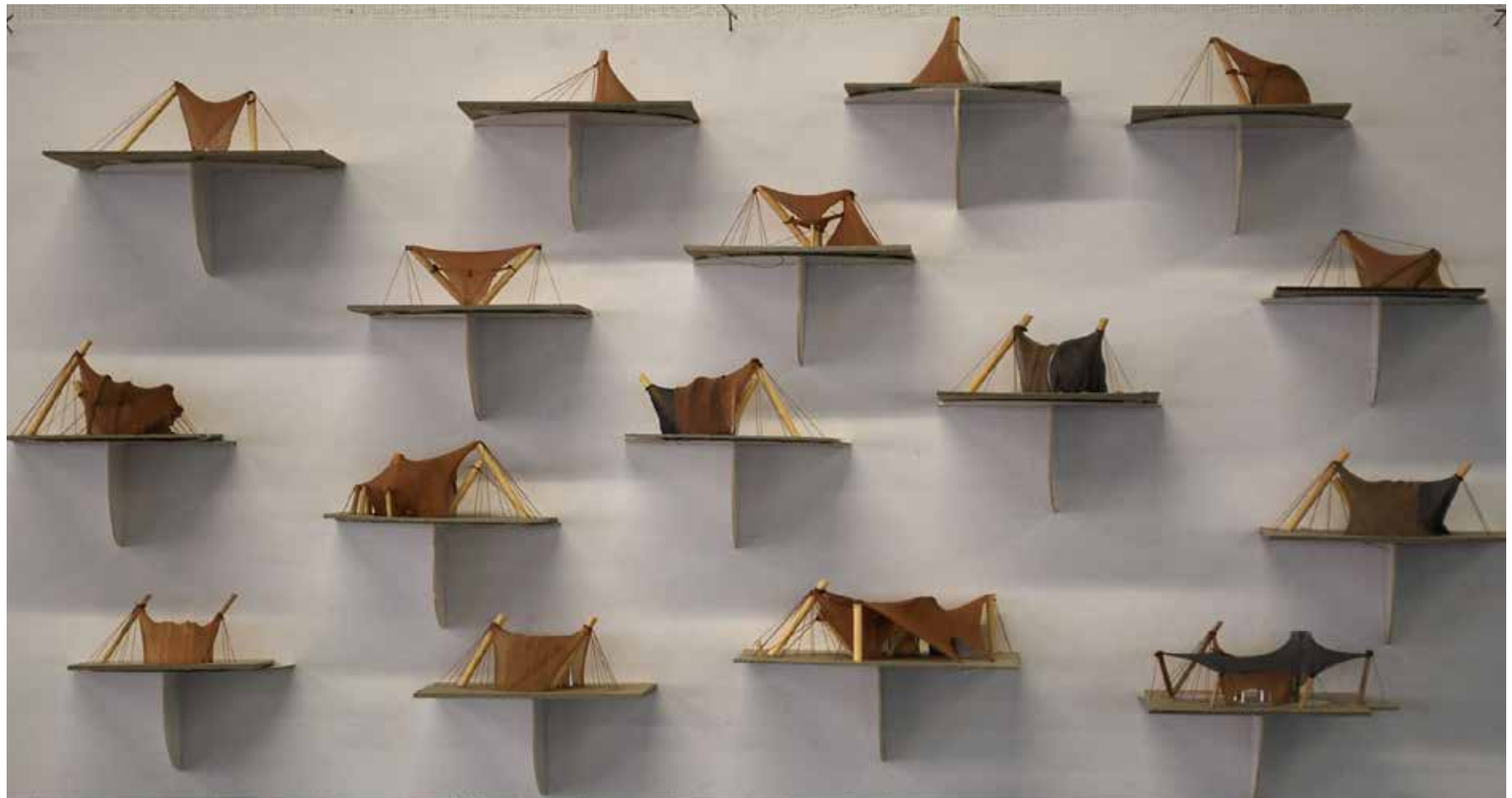


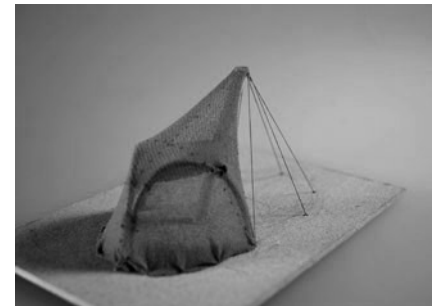
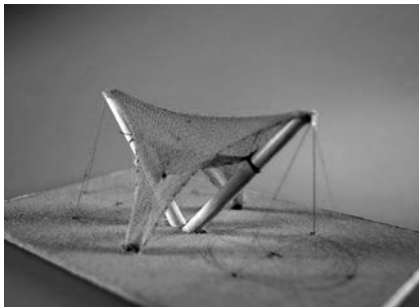
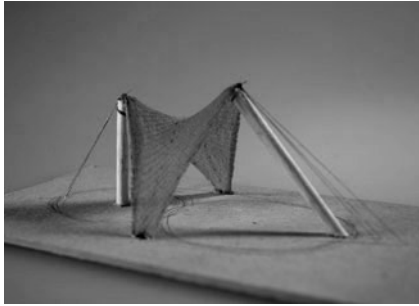
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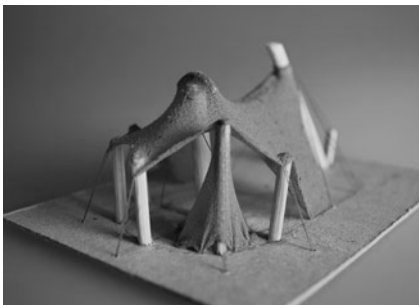
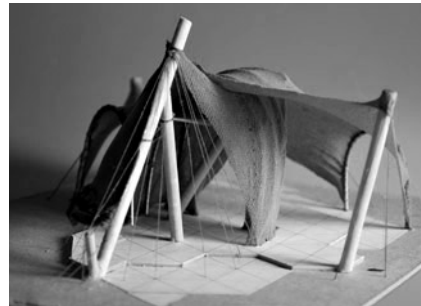
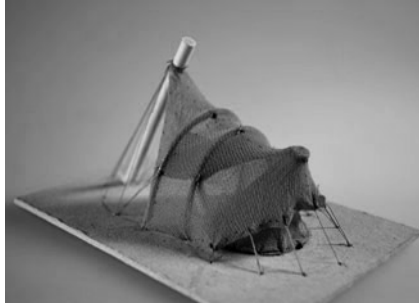


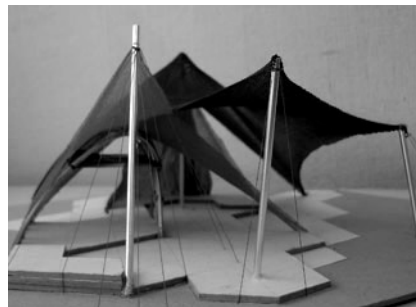
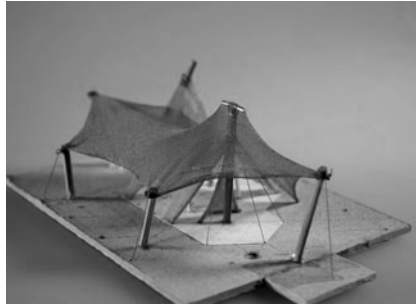
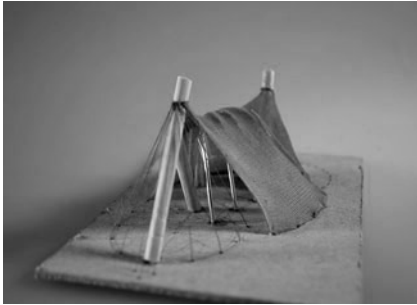


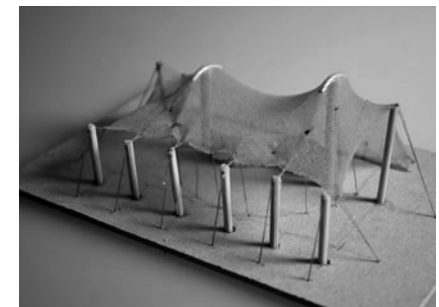


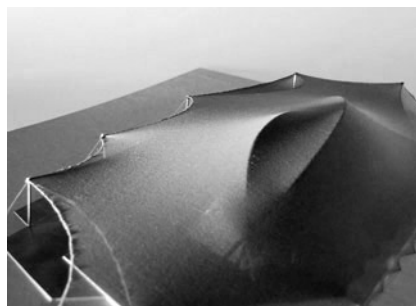
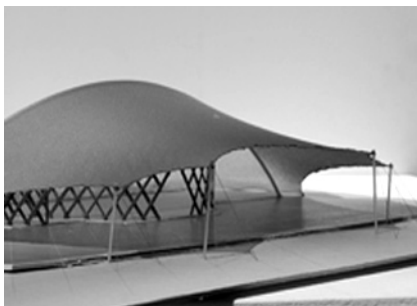
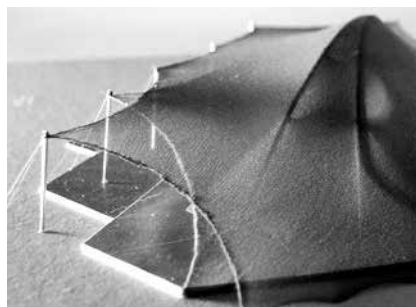
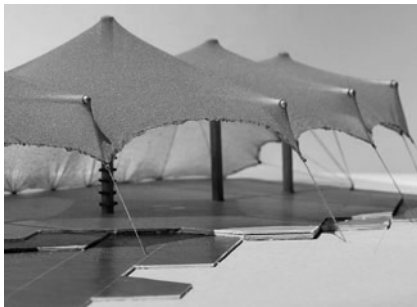
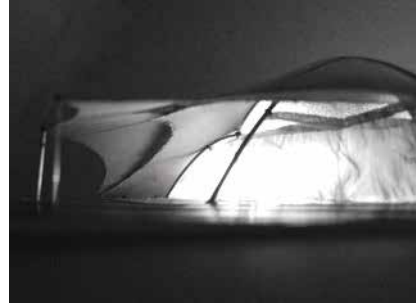
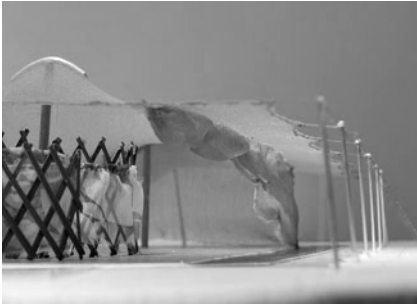












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## APPENDIX 2.

### FABRIC SAMPLES

'Ultra block' shade cloth

'Top gun' boat cover

Poly-cotton canvas

Clear reinforced P.V.C.  
[ P.V.C. base sample ]

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