

SENSING HOME  
CREATING A FRAMEWORK FOR HAPTIC LIVING

BY

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CREATING A FRAMEWORK FOR HAPTIC LIVING

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For Grandad  
I miss you every day

# ACKNOWLEDGMENTS

To my supervisor, Philippe, thank you for your guidance and insight throughout this prolonged process. Your support and patience has been invaluable.

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Most importantly, to my family. Thank you so much everything. For your never-ending support and for always believing in me.

I couldn't have done it without you all.

# ABSTRACT

This thesis looks at developing a new method of designing small living spaces using the sensory body. It intends to re-imagine ways to provide a unique experience for each occupant, while offering a new perspective on how interior architectures can be designed for living in.

In the context of a rising housing crisis and with a specific lack of accommodation for students and young professionals, living in smaller spaces is fast becoming a necessity. A large body of research into the design methods utilised for smaller living within city centres expose an omission of the senses for the greater part of the process.

This research looks at a re-thinking of interior design processes where factoring the senses takes precedence over other considerations. More specifically the role of the sense of touch as the primary motivator is considered, supported by the sense of sight as its secondary factor. A series of experiments explore the ways the body interacts with surfaces, and how tactile qualities can define a space and create form. These lead to the making of a framework for design which in turn is tested through the creation of the interior of a small dwelling.

This design-led research challenges the ways in which touch is used to design and reimagines ways in which small living spaces are created, with a focus on the senses.

Key words: Interior architecture, Exploration of the senses, Touch, Tactile design methods, Design framework, Small space living

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How can we rethink the current methods of small space design using the senses as the design driver?



# INTRODUCTION

This research will look at rethinking the way in which small space living is designed, using the senses as the design driver. Focusing on touch as the primary sense, this work aims to create a framework for designing through tactile methods, then test it through application into a small space home design.

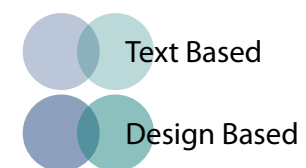
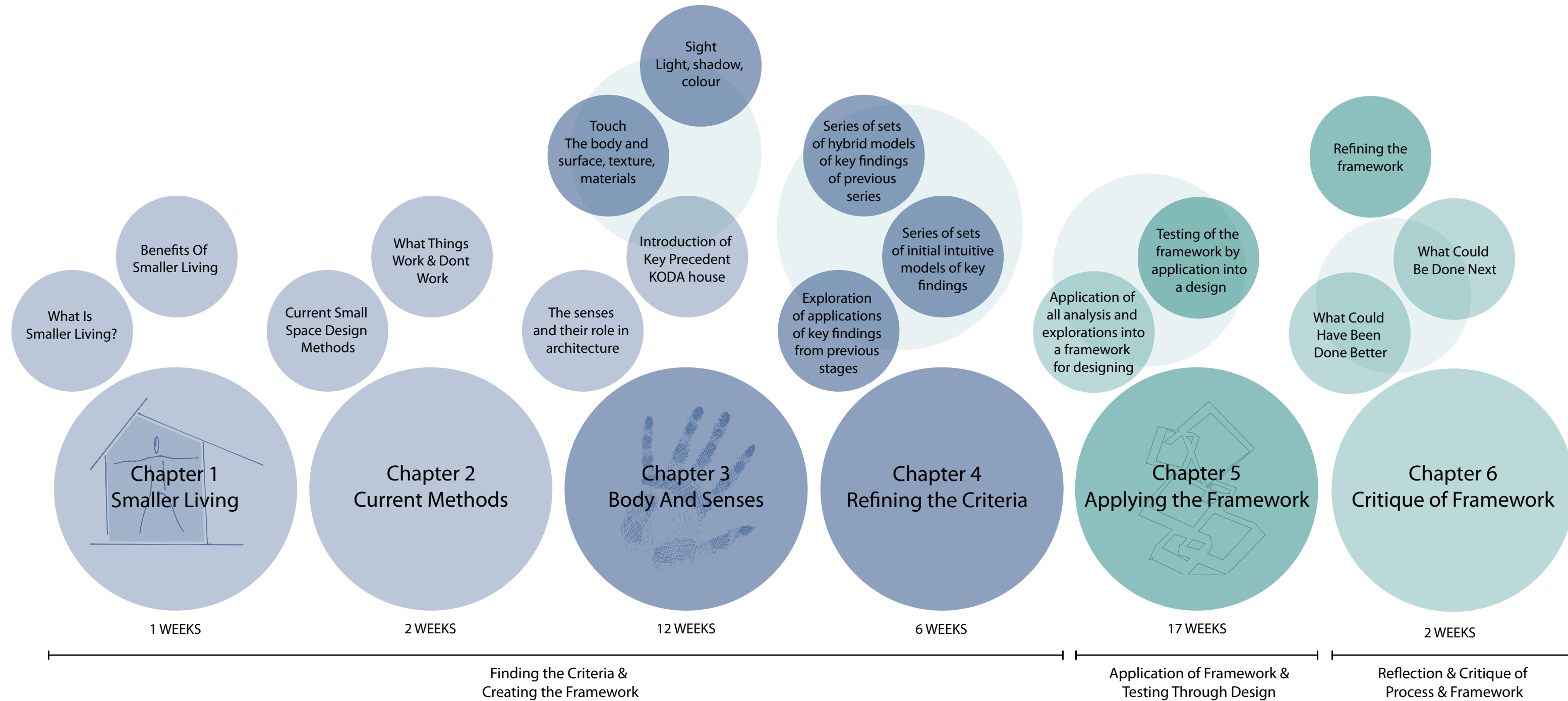
The outcome of this research is a new perspective on the way spaces can be designed. Starting with the atmosphere and emotions that should be evoked within the occupant of the dwelling, the experiments and research done inform a framework for designing to follow in order to design in consideration of the senses. Put into the context of small space living, the resulting framework will help to address the current housing crisis.

Emotion, and how a person is made to feel within a space can be triggered through memory, or through the senses. The focus of this research is on the sensory side of things. The senses are crucial to consider when designing an environment, as they are the way in which the world is perceived. Despite this, they are often neglected, or thought of only very briefly. This is a large reason as to why this work will be centring the senses as the core feature that drives the entire process. An environment is usually experienced through all of the senses simultaneously which makes it quite difficult to separate them. For the purpose of this research, however, the sense of touch will be the primary

focus. Sight will also be considered as a secondary sense due to the way it can enhance and affect the sense of touch. This is to narrow down the scope of the research. The primary methods of research into how the tactile sense can have an effect on design methods will be looking at how touch can evoke emotion, how the body interacts with different surfaces, and how tactile methods of designing can alter the outcome of the final design. This will be achieved principally through analogue processes, physical modelling, and activity-based methods of enquiry where each step informs the next.

The research will be split into six sections and moved through in chronological order. The first two sections establish the context addressing the current lack of housing, why small space living could be a good solution for this, and what small space living will be defined as for the purpose of this research, before moving into methods currently employed when designing small spaces. This is to provide a basis for the exploration further through the process. The third section highlights how the senses are currently used in the design process through experimentation and physical models as well as developing ideas found within the first two sections. The fourth section combines the findings from all previous chapters and develops them through a series of physical model sets to create a set of key criteria to use for designing. These criteria are then used to create a framework for design, a set

of steps to follow in order to design for the senses. This framework is developed and tested through design within the fifth section of the research process. By testing the framework, any issues should be found and analysed. This will help to develop the framework to be more successful. The sixth and final section will be where this analysis and refinement is done, as well as a critique and reflection of the entire process.



- 1 Develop a new way of designing in relation to the sensory body
- 2 Offer a framework that can be applied in the context of small space living to address the current housing crisis.

# CHAPTER 1

## SMALL LIVING & ITS BENEFITS

Due to an increasing housing crisis and a growing lack of space to build in, the need for smaller living spaces and high density living has been emerging within urban centres for many years. This chapter discusses smaller living and some of its benefits, touching on the sustainability, roles and advantages of smaller houses. For the purpose of this research, the size of what can be considered a tiny house, or small space living, is also defined.

The vast majority of the world's populations live in small dwellings. It remains the more common way of life in places such as Europe, Africa, and Asia due to population pressures or economic resources. In some Western countries such as the USA and Australia, however, the size of housing is increasing. In these countries the average house in the 1950s was approximately 90m<sup>2</sup>, around 25m<sup>2</sup> per person. By 2011, house sizes had expanded to an average of 241m<sup>2</sup>, while family size had decreased from 3.6 members to 2.5. This represents an increase of almost four times as much space per person at approximately 96m<sup>2</sup>. (Boeckermann et al.; Shearer and Burton; Wilson and Boehland). The resulting urban sprawl associated with the popularity of larger detached houses on large plots of land places a degree of pressure on the housing availability within the cities and create issues of dwelling distance to workplaces and educational centres.

Smaller urban living goes some way to counteracting such pressures.

Earth's population is growing and so too the drift towards city dwelling. As of 2014, more than 54% of the world's population resided in urban areas with an expected rise to 66% by 2050. Since the 1950s, an increase in people shifting to urban areas and city centres has almost doubled the negative effects on the environment, and places a strain on the existing built infrastructure and spatial requirements of the population. (Boeckermann et al.; Shearer and Burton; Wilson and Boehland). The inhabitants of Japanese cities like Tokyo and Osaka for example, are very familiar with these pressures. Having had huge populations packed into small urban areas for decades, the people of Japan have addressed some of these pressures with careful consideration of smaller living by refining techniques that minimise interior space, whilst meeting the needs of their occupants (Ford and Gomez-Lanier; Schittich).

An ever-larger number of people are attempting to scale back, with 'tiny house' and 'small home' movements growing in popularity in many western countries. The tiny house lifestyle is notably contrasting to the sprawling residences and consumerism of much of today's society. There are a large number

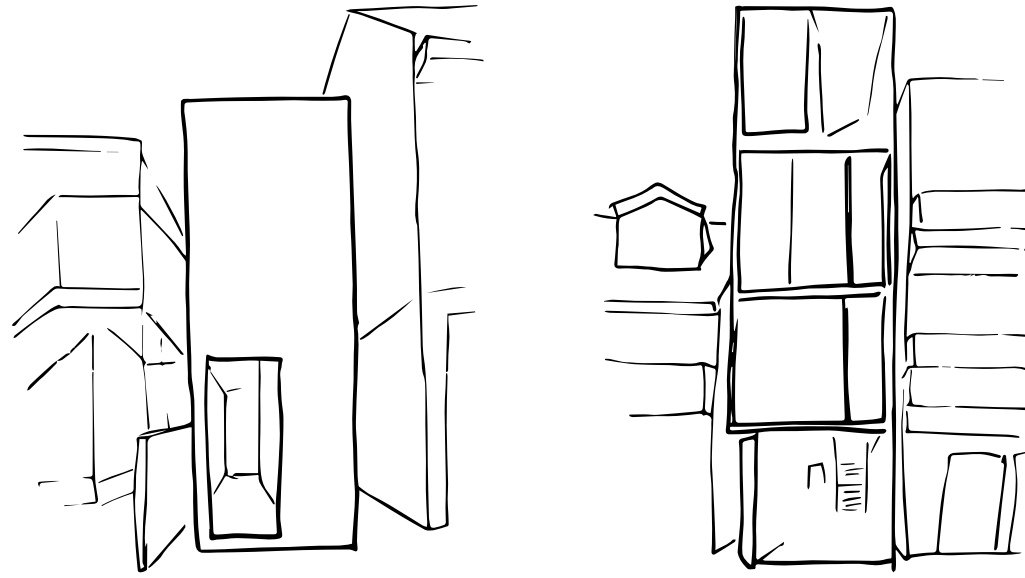


Figure.1: Author's drawing depicting entrance of Mt Fuji Architects Studio's 'Near House' in Tokyo, Japan.

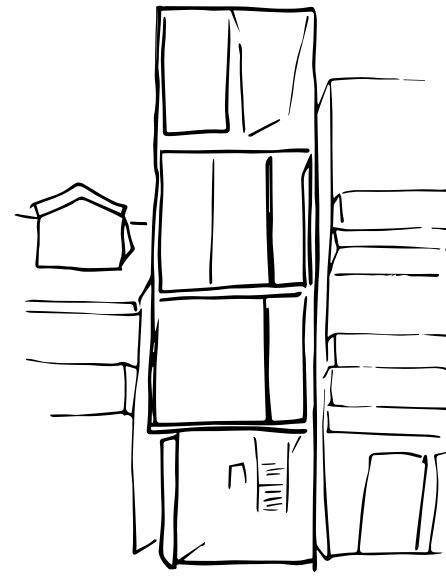


Figure.2: Author's drawing depicting the NYH residence in Osu, Naka-Ku, Nagoya, Japan by aat+Makoto Yokomizo.

of reasons for the increasing numbers of people opting to downsize their home. The people who choose to live within them are often interested in a simpler way of life, as the Tiny House movement tends to uphold values such as small is beautiful, more affordable, and more sustainable. Though the homes often vary significantly in complexity, size, and cost; smaller dwellings also generally cut down the costs of living. (Boeckermann et al.; Ford and Gomez-Lanier; Shearer and Burton).

It is argued that nature is greatly impacted by the built environment, and that construction and housing are major contributors to greenhouse gas emissions. Some tiny house owners claim that their primary motivation for downsizing is due to the environmental benefits and sustainability of the tiny house. Larger homes with a greater number of floors often mean an expensive use of energy

and resources through construction, maintenance, and operation; as well as contribution to greenhouse gas emissions through the heating and cooling of the building, and increased water use within the household. A larger floorplan with multiple floors carries a larger carbon footprint. Fewer floors have provide a greater efficiency of energy and resource. Thus, a reduction in the size and cost of a house could save significant amounts of energy and resources in proportion to its footprint. Incorporation of rainwater collection systems and alternative energy sources such as solar as well as the use of recycled or natural materials enhance energy savings and reduce environmental impacts. With a smaller surface area and lower energy requirements for heating, lighting and appliances, tiny homes are more considerably more energy efficient than the average American home. (Shearer and Burton; Boeckermann et al.; Wilson and Boehland; Kilman; Schittich).

Carbon emissions could also be reduced through increased density of housing in and around the central business district as well as placing greater value on renovation and reworking interior spaces over new building. (Schittich). In terms of direct human environmental impacts, not only does the choice to construct a small home benefit the environment, the smaller dwelling also encourages the owner within it to lead a more minimalist lifestyle through necessity thus restricting consumption and waste.

Inhabitants of smaller homes have to live a more minimalist style, as limited space means the quantity of belongings is restricted to just what is necessary to live in order to keep an uncluttered home. The intrinsic worth of a move away from consumerism and materialistic values is also one of the key philosophies of the tiny house movement. Smaller living also offers people independence and

freedom, the ability to more easily design their own house, and opportunities to develop a sense of community with likeminded people. (Boeckermann et al.; Shearer and Burton; Simon and Touns; Mingoya; Ford and Gomez-Lanier). Not only does smaller space living celebrate individuality, it has the ability to cultivate social transformations in how the individuals within these tiny houses relate to one-another and interact as a group when a tiny house village and community is developed. Tiny housing has been proposed as a solution to providing housing for a large number of people within a small area and with this a rise in tiny house villages is evolving. (Ford and Gomez-Lanier; Kilman; Schittich). In these villages, relationships and social networks are emphasised, as people are almost forced to socialise and perform certain tasks in community space rather than within their home. (Shearer and Burton; Kilman).

Wider effects on physiological, psychological, and sociological health should also be taken into consideration when planning small homes. Due to the limited volume of a small home, task areas, as well as the overall space, must be arranged and designed with efficiency and intention to provide a sense of separation or spaciousness as well as a functional, accessible layout. Even within a well-designed small home, the minimal volume limits personal space and privacy; sometimes resulting in emotional and physical challenges. The tiny lifestyle is not suitable for everybody. It does, however, show a lot of promise among certain demographics. (Simon and Touns; Kilman; Ford and Gomez-Lanier).

There are many different demographics that choose to live in smaller dwellings, from the young adults and students

with lower incomes, that will be the key demographic used for this study, to retirees and people wishing to live a simpler and more sustainable life. There is also a large push towards using small space living as a way to help the homeless. Multiple authors have discussed utilising tiny houses as a solution to homelessness, with multiple examples already in place across the USA. Due to minimal spatial requirements and low construction costs they are an attractive solution for providing permanent or semi-permanent housing for groups of individuals and families with little to no income. The use of tiny houses for the homeless is often in the form of 'villages' where a number of homes are clustered together, often sharing amenities such as showers and toilets. Cities such as Portland, Oregon and Austin, Texas have either put in place, or have announced an intention to develop tiny house villages aimed towards this vulnerable population. There is also a tiny house village for homeless in East Auckland, New Zealand that consists of 13 homes and houses over 50 people. Another is proposed to open in Muriwai, New Zealand. There have been multiple studies done into these villages and their benefits. These show not only the potential to save tens of thousands of dollars for the cities in terms of emergency health and public safety costs, but also a huge improvement to the way of life for the homeless people affected. Providing safe storage, privacy, and a place to call home can be a huge help in stabilising and regaining mental and physical strength. The village structure may also benefit the emotional wellbeing of people housed within them to generate bonds with other people, forming communities. (Boeckermann et al.; Mingoya; Ford and Gomez-Lanier; First Tiny Homes Village Launches in New Zealand, All Things Property, under OneRoof; 'Good Sorts').

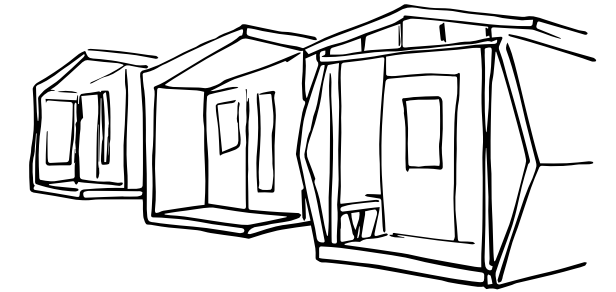


Figure.3: Author's drawing depicting the "Sleeping Pods" designed to shelter homeless women in Portland, Oregon, USA.



Figure.4: Author's drawing depicting the Tiny House village for Homeless people in East Auckland, New Zealand.

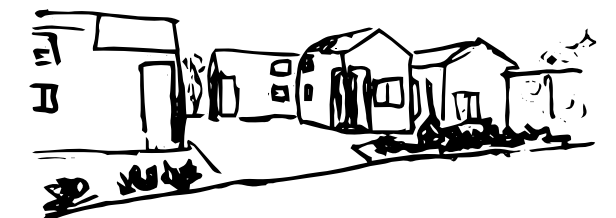


Figure.5: Author's drawing depicting the proposed Tiny House village for Homeless people in Muriwai, New Zealand.



Figure.6: Author's drawing depicting the Cottages at Hickory Crossing. A tiny house village for homeless people in Dallas Texas.



It should be stated that this thesis will not be looking at the tiny house movement itself, but more broadly small space living. These topics often go hand in hand, and there are many useful techniques from the 'Tiny House Movement' that can be utilised in other small spaces, which will be looked into further in the next chapter. Parameters used within the Tiny House Movement will help determine size ranges when defining smaller space living. Surprisingly the drift towards living in smaller buildings in the US can be traced back to the 1850s according to Shearer and Burton's article Towards a Typology of Tiny Houses, and is said to be due to a pursuit of simpler living, freedom, and individualism, but what actually constitutes small space living?

There is much discussion and ambiguity over the definition of a tiny house. Sizes can vary in relation to cultural norms. There is a large range of sizes specified across texts for the standard footprint square meterage with the smallest being 6.5m<sup>2</sup> and the largest being 37m<sup>2</sup>. Generally, definitions for the size of a tiny house exclude loft areas and external space such as decks. Multiple texts also refer to the International Code Council (ICC) and International Residential Code (IRC) parameters. These state that every dwelling unit must have at least one room of a minimum 120sqft (11.14m<sup>2</sup>), with other habitable rooms being no smaller than 70sqft (6.5m<sup>2</sup>). The IRC, which is a part of the ICC, state in Appendix Q that a tiny house is a dwelling with a floor area of 400sqft (37m<sup>2</sup>) or less excluding lofts. This dimension of 37m<sup>2</sup> will be the top end dimension for small space living for the duration of this research. (Shearer and Burton; Boeckermann et al.; Mingoya; Ford and Gomez-Lanier; Kilman; IRC2018P3 - APPENDIX Q).

The definition of small space living must fit within legal requirements, so New Zealand Regulations will have to be taken into consideration for this study's New Zealand context. Legislation on the Minimum Standards of Fitness for Houses stipulates that a house must have rooms capable of being used as a living room; a kitchen or kitchenette; a room capable of being a bedroom; and a bathroom with a toilet that is exclusively for the use of the occupants of the dwelling. It must also have adequate provisions for washing clothes if the dwelling is intended for more than two occupants. It specifies in terms of minimum floor area that the living room and kitchen do not need to be separate rooms if the space designated for them is at least 9sqm in an existing house, or 14sqm in a new build. If a dwelling is only accommodating 1-2 people and the bedroom and living room are to be combined, then the minimum size for this space is 14sqm. If the bedroom and living room are combined, the kitchen must be a separate space. (Housing Improvement Regulations 1947 (SR 1947/200) (as at 01 July 2013) – New Zealand Legislation).

In summary, as the average house size has increased, and the family size has decreased, the average square foot of housing per person has risen significantly. This combined with a rise in people moving towards city centres, and growing urban sprawl, is creating a shortage of available space, as well as putting a strain on the built environment and amplifying negative impacts to the environment. The need to live smaller, and in higher density, is becoming more apparent and is emerging as a solution to many housing issues in an urban context, including the lack of urban space and affordable housing. The tiny house movement encourages people

to lead a simpler life, while decreasing the cost of living, and the environmental impact of housing. Reductions in carbon footprints, energy use, consumerism, and waste are all benefits of smaller living. Although this lifestyle is not the best fit for some populations, a lot of promise is shown among many others, including as a potential solution to homelessness. Sizes of small space living can vary between countries due to regulations and cultural norms. For the purpose of this thesis it will be no smaller than 11m<sup>2</sup> excluding kitchen and bathroom areas, as per New Zealand Legislation, and no larger than 37m<sup>2</sup> excluding lofts, as per other texts including the International Residential Code.

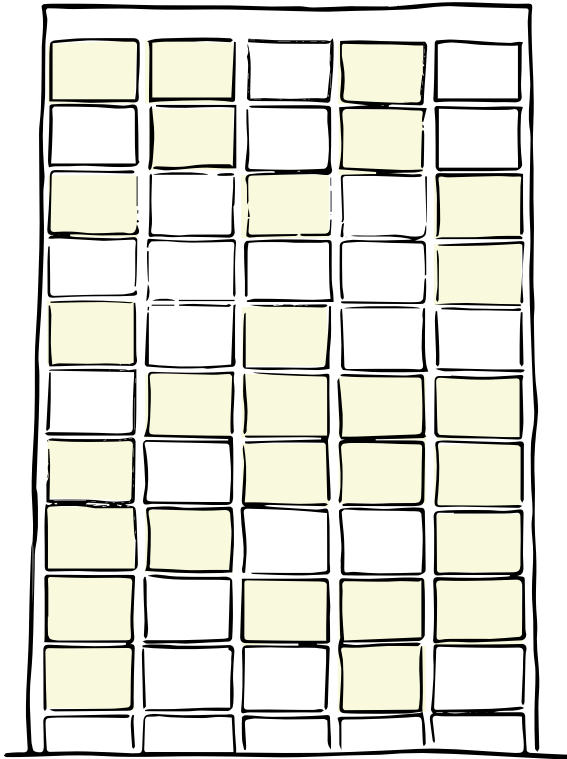


Figure.7: Author's drawing depicting high density apartment living.



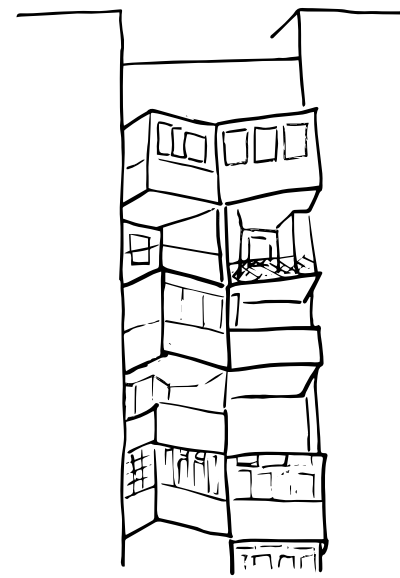


Figure.8: Author's drawing depicting high density apartment living.

## Key Findings from Chapter 1

- Smaller living is a potential solution to the growing housing crisis and is slowly becoming more of a necessity.
- A majority of tiny houses have all amenities for sleeping, storage, cooking, and personal hygiene
- A dwelling that is intended to accommodate at least two people must have a living room; a kitchen or kitchenette; a bedroom; a bathroom with a toilet; and adequate provision for washing clothes.
- If the kitchen and living space are combined then the bedroom must be separate. The combined room must be no smaller than 14m<sup>2</sup>.
- A tiny house is classed as a dwelling that is 37m<sup>2</sup> or less in floor area excluding lofts

To be considered for framework:

Must have a bedroom, kitchen/kitchenette, bathroom, laundry, storage space, and living room. The bedroom should be a separate space.

Maximum footprint of 37m<sup>2</sup>

# CHAPTER 2

## AN ANALYSIS OF THE CURRENT METHODS OF DESIGNING SMALL SPACES

This chapter looks into current methods of designing small living spaces. This is done to figure out what has already been done and to find things that work which can be utilised throughout the research process.

Modern family homes are generally designed to accommodate the daily functions of domestic and household life. Home design often reflects cultural norms and the values of society, as well as allowing space for living, separate from work spaces. In his text *Body, Memory, and Architecture*, Kent Bloomer talks about historian Geoffrey Scott and his takes on the body in architecture. Scott discussed how we, as humans, are subconsciously compelled to identify with apparent weight, pressure, and resistance within the forms we see as part of our habitual body experience, due to mimetic instinct – a natural instinct to imitate or represent. Humans project their own experiences onto something in order to identify with it and gauge the scale and touch of it through what we know to be

true from our own bodily knowledge. As someone’s most personal possession, the home usually echoes one’s social status, self-expression, and self-identity, and the person or family within should be able to occupy all parts of it. The home is associated with a sense of comfort, as well as physical and physiological security so it regularly mirrors the occupant’s personal preferences and historical past. This is an important reason for why the home should be designed to suit the needs of the occupant. (Mingoya; Steward; Bloomer 27, 47). Scott also talks about scale and ornament, stating that there are three forms of ‘bigness’ distinguishable in any building; mechanical, the bigness it actually has; visual, what it appears to have; and bodily, the feeling it gives. The bodily measurement of a feeling of bigness, or how the space makes one feel in relation to the building, is what has aesthetic value according to Scott. (Bloomer 27–28). This is important to note, as the senses are significantly involved in this perception of space, and can be fooled into identifying the scale of space incorrectly with certain

triggers that change the distinguished ‘bigness’ between its forms. The bodily measurement of bigness that relies on the feeling provoked within the space is key to creating a positive aesthetic experience playing on the sensory elements of design and may underpin the emotional and practical outcomes for people living in a smaller space.

Although small homes can vary greatly, they generally incorporate all of the common amenities of a regular house but in a more compact package. While features of any house vary depending on the preference of the owner, small homes often contain areas for sleeping, bathing, storage, and cooking, arranged as multifunctional rooms in order to maximise space. From convertible couches and foldaway tables to sleeping lofts and clever shelving solutions, there is no shortage of techniques used in tiny homes to solve the issues of limited space. Small dwellings require efficiency in their design and a high quality of craftsmanship in order to maintain

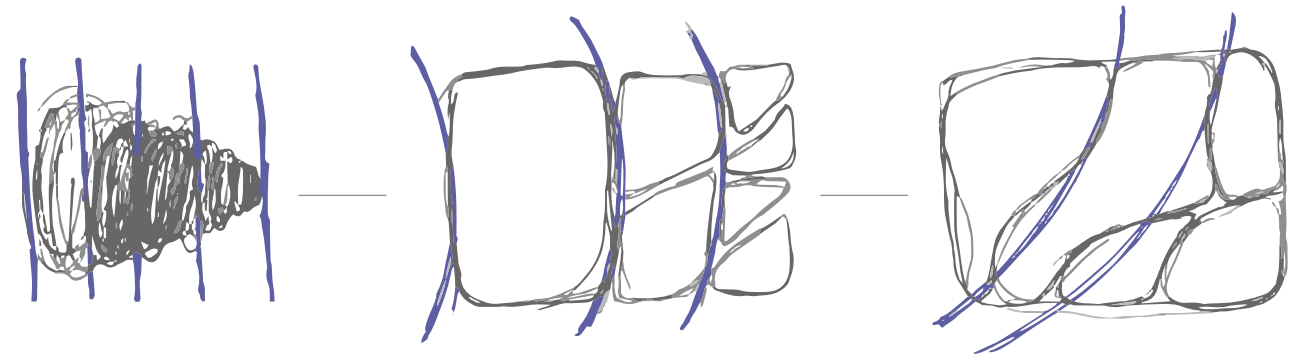


Figure 9: Author's drawing showing the concept of the intimacy gradient informing the way space is created and divided.

comfort levels and to utilise space as effectively as possible. Accommodating separate spaces in a restricted floorplan can be difficult. As the functions of each space vary, so does the minimum space required. (Mingoya; Kilman; Simon and Touns). Many of the required areas of the home have spaces with overlapping functions that can be designed into the same space. Examples of this range from dual-function kitchen and dining areas to the transformation from living room to bedroom with full sized hidden beds being revealed with the flip of a switch. Depending on privacy requirements and the effect of how the space feels on the psychological health of the occupants of the small space, there may be just one large space with many overlapping functions. Ensuring that no space serves only one purpose, with the exception of the bathroom, minimises wasted space, as few areas within the home are left unoccupied or under-utilised for large periods of time. Circulation spaces are eliminated wherever possible, and where they cannot be removed, they often serve multiple purposes. This can be seen in the common strategies of removing circulation space around the bed by putting it into a

loft or an alcove; using stowaway furniture that can transform its function or fold into walls; and using the area beneath stairs as storage. As well as removing circulation space, the maximisation of vertical space with shelving and lofts for example, is key to minimising wasted space. (Simon and Touns; Ford and Gomez-Lanier; Kilman; Wilson and Boehland).

Frequent inclusions of small homes include dual function storage pieces, built-in cabinets and hidden storage, and using all the small otherwise wasted or awkward spaces formed by elements such as staircases and corner cabinets in kitchens. The ability to convert a space with multipurpose, transformable and stowable furniture and furnishings that allow for changing access routes, depending on the varied functions and activities of daily living is a crucial strategy to reduce the burden of clutter and physical/visual protrusions. Clutter appears more prominent and noticeable in smaller spaces, as it interrupts lines of sight, hiding key visual cues that work to define the space. Uncluttered space with strong visual cues, sight lines, and stowable solutions can draw the eye to

the desirable aspects of the space, such as spaciousness or high ceilings. The ability to change a space with minimal difficulty or disruption to frequently used appliances and other spaces around it is a key consideration. Ease of access routes to storage and frequently used items must be considered. Clever use of moveable walls and storage to reconfigure an area and its volume to meet the minimum spatial requirements of the tasks that occupants are performing at the time is another way to manipulate both their sense of space and their comfort and efficacy in that space. (Simon and Touns; Ford and Gomez-Lanier; Wilson and Boehland).

With sight being regarded as possibly the most significant factor in design and art, the visual feel of a confined space has been explored extensively and the aesthetic feel of small homes has been gradually improved over years of experimentation and scrutiny. Visual perception is the primary way in which the senses come into play and are designed for in current architectural methods. There are a large number of visual tricks that can be drawn upon when designing a small space or dwelling, in order to make a space feel less

constricting by altering the perception of space. Simon and Touns in their text *Innovation in Deep Space Habitat Interior Design: Lessons Learned from Small Space Design in Terrestrial Architecture*, discuss a set of common, visually focused features that they found through their research. When these visual tactics are used alongside clever space saving techniques and storage solutions, homes can successfully be constructed to a high quality within tight size constrictions. (Ford and Gomez-Lanier; Simon and Touns; Bloomer 28–29).

Internally, the ratio between room size and ceiling height is a valuable tool in making a room feel more or less spacious. High ceilings draw the eye upwards, emphasising underutilised space. The perception of spaciousness is enhanced when the space towards the ceiling is uncluttered and open above waist height. This is only the case until the height of the ceiling exceeds the dimensions of the room as the room then begins to appear narrow and out of proportion. (Simon and Touns; Ford and Gomez-Lanier; Wilson and Boehland). This perception of spaciousness or openness is reduced by

anything that protrudes into the perceived living space at a general eye level, thus shortening sight lines. The interruption of sight lines can be prevented through the use of transparent furniture, smaller appliances that can be easily stowed away, and negative space. Negative space can be created through multiple ways, such as elevating objects from the floor, or designing in recessed details. Longer sight lines, often associated with larger spaces, can be created through diagonal lines, as the longest line of sight becomes the focus of which the perception of space size often depends. Interior windows can also be used to achieve a longer line of sight in areas where walls and physical barriers are necessary. Lighter colours can be used to help make a space feel larger as brighter areas make a space feel more open. This is especially emphasised when contrasted with dark accents. (Simon and Touns; Ford and Gomez-Lanier; Wilson and Boehland).

Some of the innovative partitioning techniques encountered in Japanese housing are reflected in smaller houses being built in other countries, as they take advantage of the space planning,

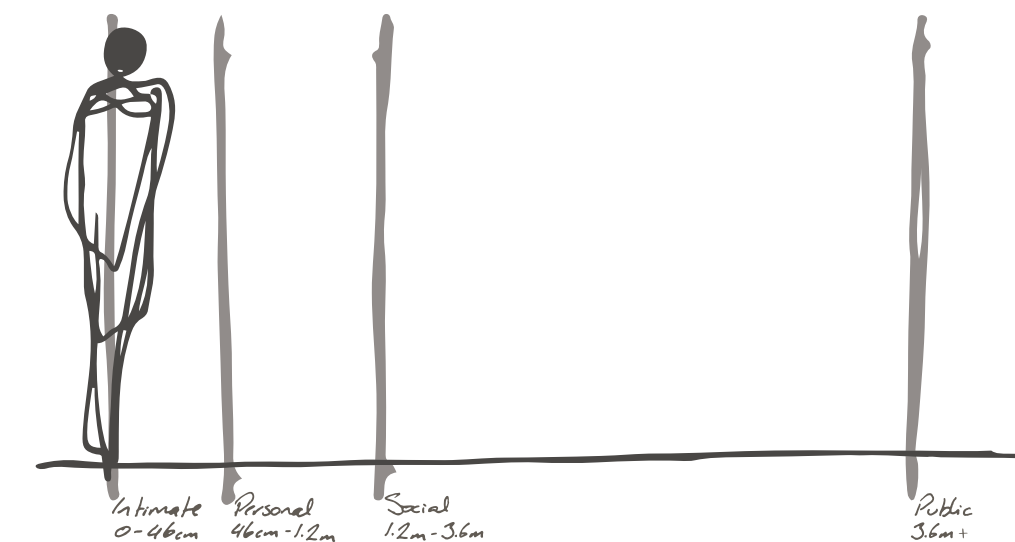


Figure 10: Author's drawings showing relative distances from Hall's work on Proxemics

materials, and construction methods. The removal of interior walls can visually open a space up and allow natural light to penetrate further through the space. This, along with half-height walls or moveable partitions, prevents spaces from being entirely closed off from each other and allows for longer sightlines and continuity of space, making the room feel more spacious; however, privacy levels are reduced. Because of this, there must be consideration to which areas are public or private, as well as the schedule and time in which the spaces are occupied. In most styles of living space there is some form of intimacy gradient, in which private spaces can be fully sectioned off or partitioned from the more public areas. (Kilman; Ford and Gomez-Lanier; Simon and Touns; Wilson and Boehland).

An intimacy gradient is where levels of privacy graduate from common spaces to private areas as one progresses through the dwelling. The level of privacy and the rate of escalation between levels varies in degree depending on cultural norms and building styles of the country in which they are expressed. The level of comfort with the proximity of other people also varies between cultures and is often a subconscious, unwritten rule within each culture that can cause misunderstandings and evoke entirely different emotions in cross cultural experiences and contexts. Each culture tends to respond to space differently in terms of both physical space, and sensory triggers. In general western practice, rooms and spaces are sized according to their function, with areas and regions used for common social interaction being larger and private spaces being smaller. Sleeping, bathing, and dressing, are examples of activities generally limited to the more private areas of a home. These smaller rooms serve to provide an escape or sense of isolation



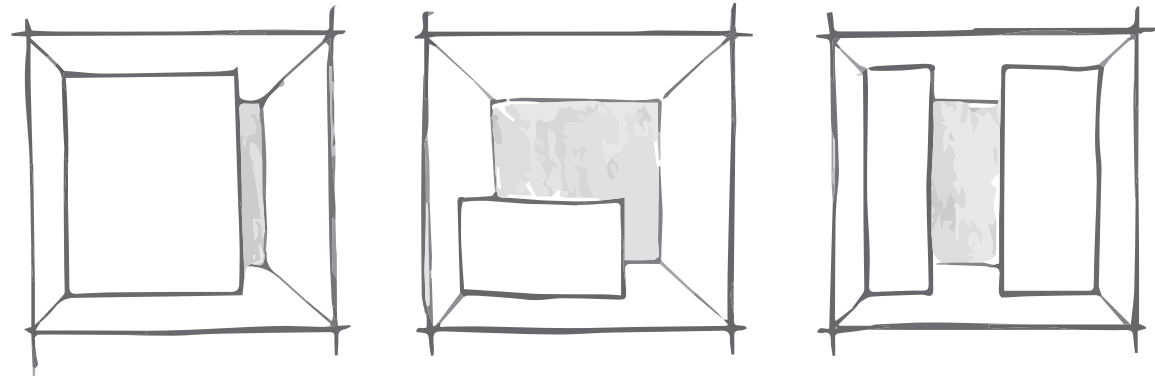


Figure.11: Author's drawings showing how wall configuration and height can alter the perception of a space

and protection from the activities lived in larger more public rooms. They often utilise doors and entryways to announce this transition. (Simon and Troups; Bloomer 48; Hall et al.)

Subtle intimacy gradients are difficult to achieve within a small living space such as a tiny house due to the limited volume. There are, however, ways to circumnavigate the issues that arise in terms of a lack of privacy or room separation. Edward Hall discusses space in its own form of intimacy gradient, with the closer two people are, the more intimate it is. He essentially splits space up into Intimate (0-46cm), Personal (46cm-1.2m), Social (1.2-3.6m), and Public (3.6m+). (Hall et al.). The relative arrangement of the household functions should be in keeping with the level of privacy required, as well as the order in which they will be accessed over the day and the time spent within. The most frequently used spaces should be the most accessible, and those with functions that overlap, are closely related, or sequential, should be linked together to simplify transitions and save on space.

This would also have the potential to reduce design complexity. Partitioning also helps to define the space, to give it an identity and a sense of moving from one space to another for certain tasks to occur. From a change in colour, material, or lighting, to the more obvious physical barriers such as walls, room dividers, and doors; partitions can be permanent or temporary and can vary in their degree of subtlety. Visual, olfactory, auditory, and tactile cues can all be used to create a separation of spaces, using the senses to detect a change in environment. The effects mentioned above to enlarge a space could also be achieved through the use of mirrors. Large mirrors replicate an extension of the room, increase sight lines and reflect light, making a room feel larger and brighter. The use of light and transparent material in windows and walls is another technique to enhance the perception of space. Internal and external clear glass allows natural light to penetrate into a space, contributes to creating an illusion of more space, visually opens the area, expands sightlines and connects occupants to other rooms or to

the external environment. (Kilman; Ford and Gomez-Lanier; Simon and Troups; Wilson and Boehland). Many features and techniques are prevalent in all forms of small housing, so although the outcome of this research will be set in New Zealand, the overall principles will be applicable in many other situations and cultures.

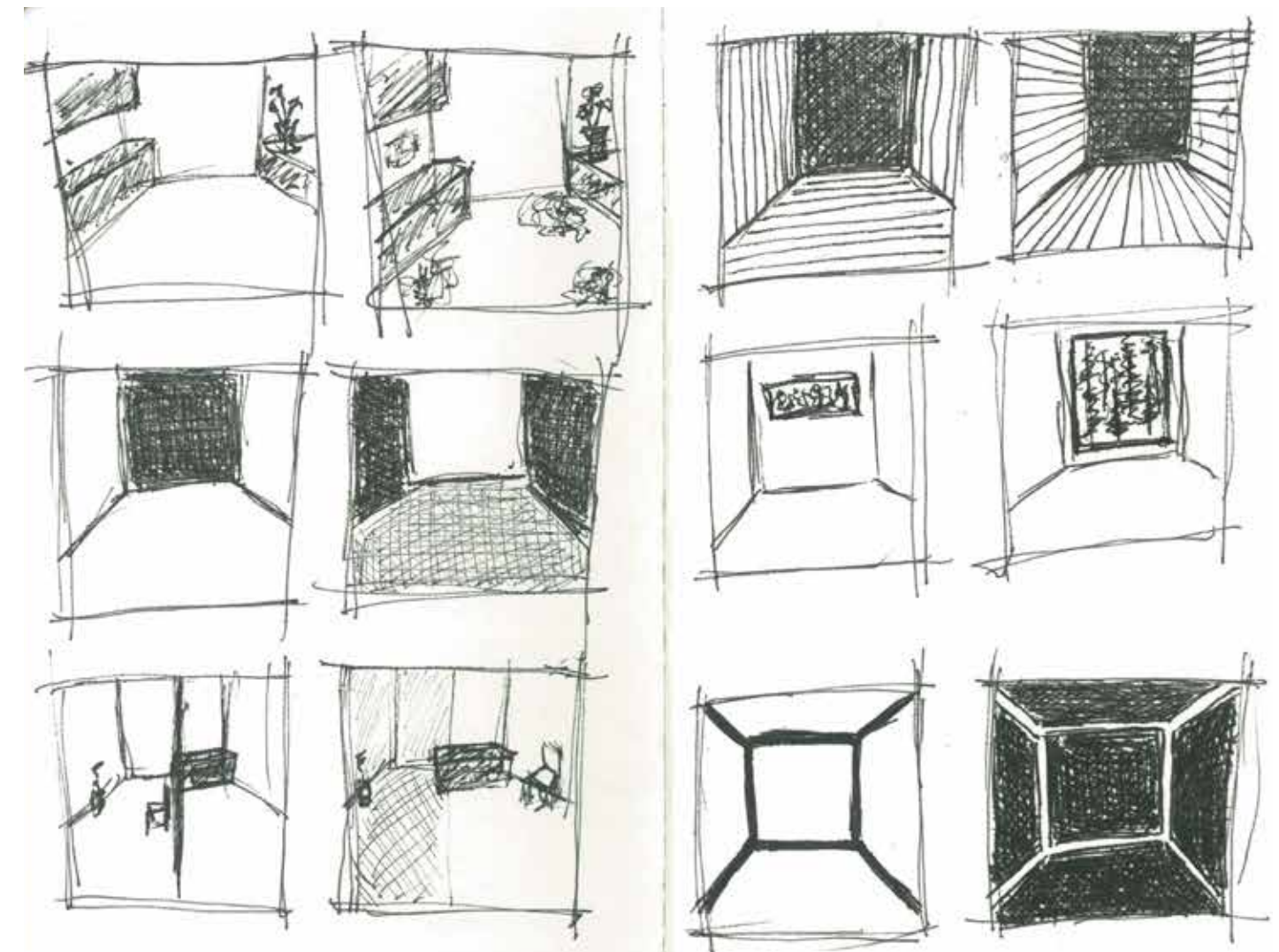
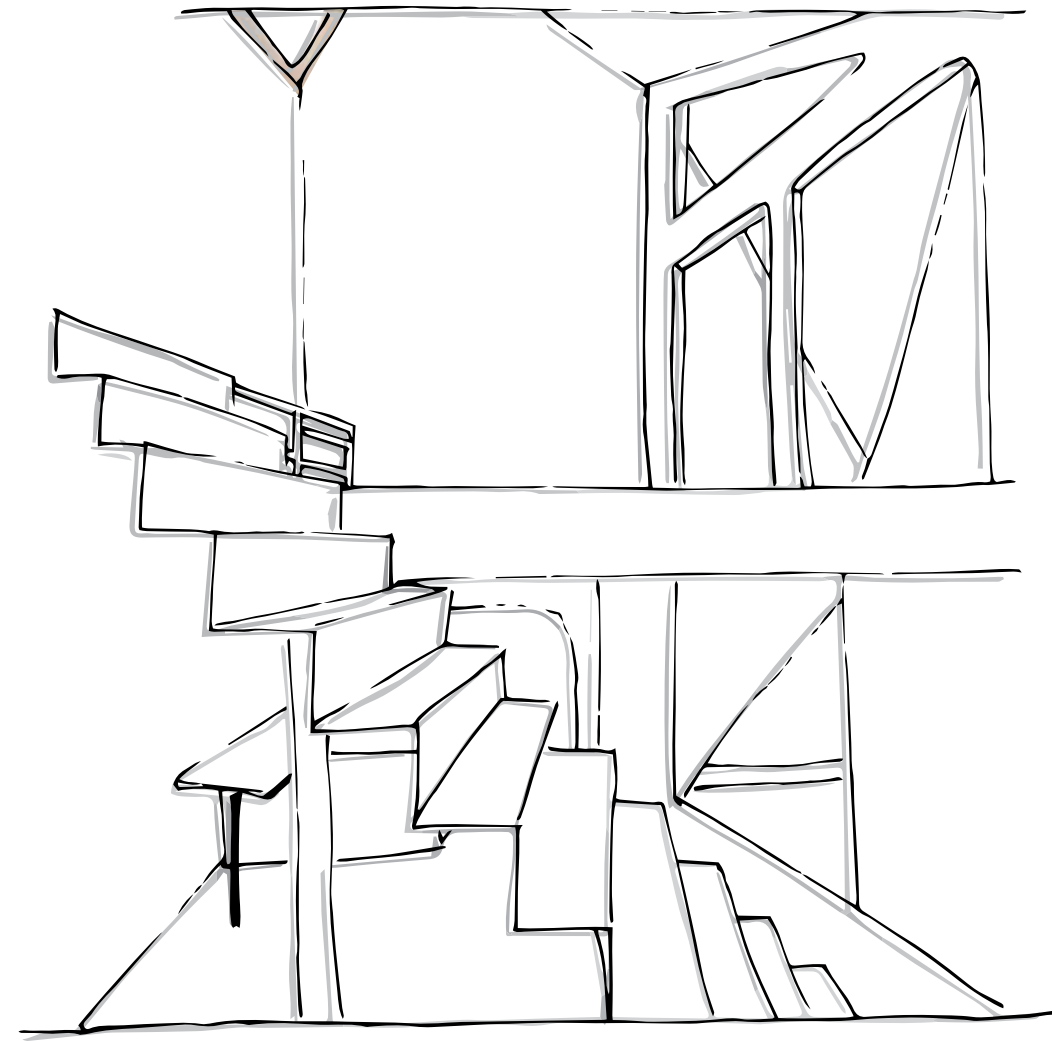


Figure.12: Author's drawings showing techniques to make a space feel larger; Tidy vs messy; Vertical vs Horizontal lines; Light vs dark colours - Feature wall; Small vs large windows; Physical barrier vs change in colour/material; Light vs dark - boundary differentiation and lines of sight.



Figures.12-13: Author's drawings depicting the Herringbone House by the firm Flathouse in Tokyo, Japan.

## Key Findings from Chapter 2

- Common techniques used in tiny homes include: multi-functional spaces, convertible furniture, sleeping lofts, clever storage solutions, limited circulation space, maximisation of vertical space, high ceilings, uncluttered spaces, negative detail/space, longer sight lines, diagonal lines, lighter colours with dark accents, use of internal windows and windows in an array of shapes and sizes or semi-concealed at the top or base of a wall, lots of natural light, lots of natural materials and foliage increasing circadian benefits, interaction with the outdoors expanding a space, removal of interior walls or use of half-height or partition walls extending sight lines, mirrors
- Access routes to storage must be considered
- Allowing occupant to reconfigure interior through movable walls allows personalisation of space as well as ability to transform space into multiple compositions and tasks.
- Clear and easily understood spaces in terms of shape and size are important for clarity.
- Indirect or diffused lighting and avoiding glossy surfaces helps to avoid glare
- Edges and surface textures are important in differentiating between spaces and objects.
- A large percentage of tiny homes have full sized toilets and showers
- Separation of spaces can be done through physical barriers, changes in colour, lighting, or materials. Visual, tactile, and olfactory cues can be used to differentiate between spaces as well.

To be considered for framework:

Minimise circulation space

Maximise vertical space

Multifunctional spaces are crucial

Edges and textures are important to differentiate between spaces and objects

Separation between spaces can be done through physical barriers, changes in colour, lighting, materials, visual cues, and tactile cues

# CHAPTER 3

## THE SENSES & BODY IN DESIGN

### FINDING THE CRITERIA

This chapter looks at the body and senses, focusing primarily on touch and sight, while considering only briefly hearing, smell, and taste. From written research and a series of experiments, key criteria will be pulled out to use in the following chapters to shape the design of a small space which could be part of a larger housing solution. The experiments will begin with elements found in the written research and precedent studies. The findings from these initial experiments will then be applied against an existing model of small space living known as the KODA House. This step will help to refine the findings into usable criteria. The KODA House is introduced and analysed at the beginning of this chapter, providing context for the experiments further on throughout the various sub-sections.

There are 5 commonly accepted senses; touch, taste, smell, vision, and hearing. Each of the senses relate directly to a sensory organ – skin, tastebuds, nose, eyes, and ears – and it is through these senses and organs that the world is perceived. The senses never rest, and are constantly perceiving and translating our surroundings, both directly and indirectly. Most features of the environment can

be detected by at least 2 senses. Vision is usually one of these. The process of perception begins with the meeting of body and object which then passes information from our sensory organs to the brain in a number of ways. This information is decoded and given meaning on a mental, physical, and emotional level. Based on what the individual sees, hears, touches, smells, and tastes, an experience will be evaluated as to whether it was enjoyable or not. Often an experience will be judged differently depending on how someone feels at the time. This can leave a memory in someone's mind that is then associated with the environment around them, making consideration of the senses during the design of an environment crucial. (Solon 21–23; Reghukumar).

How a building makes someone feel is a fundamental aspect of design, and can control how a person behaves and thinks. Both the atmosphere within a space and the wellbeing of the occupant can be controlled significantly through the senses and the parameters that affect them. Many elements such as form, size, sound, light, and texture are identified and comprehended from the information received from the environment. (Reghukumar; Ryhl 107). The built environment consistently influences the way people move through space in the form of a dialogue between one's body and its surroundings. Architecture has the ability to provide provocation for movement and action, as well as providing a script of sorts in which the people within are encouraged to move in a certain way, whether consciously or subconsciously. Emotional responses are triggered by environmental stimuli that are produced depending on the interaction between user and space. These emotional responses relate to both the emotions of the user within the space,

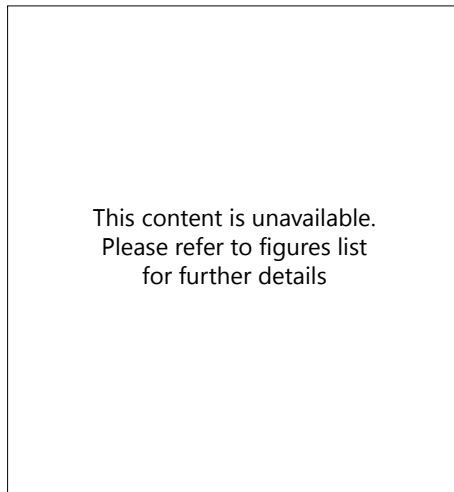


Figure.14:Da Vinci's Vitruvian Man

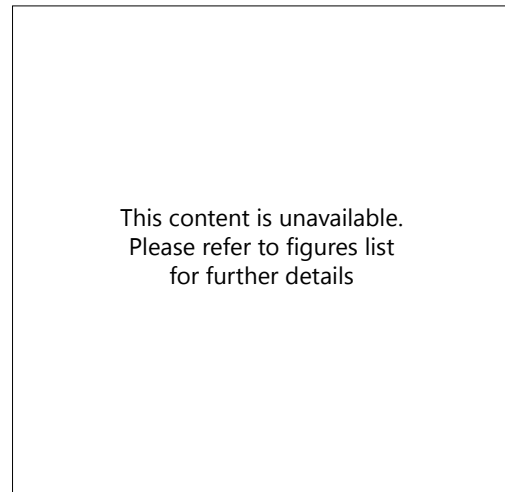


Figure.15:Le Corbusier's Modular

and their resulting interaction with the space. The interaction between a body and its surroundings create a dialogue and redefine one another regularly, so it is inevitable that the senses will be present in architecture whether they were designed for or not. A space that does not consciously take the senses into consideration will have significantly less of the desired effect on the occupant than one that uses all of the senses to create an atmosphere that will leave a lasting impression. Someone who experiences a space through all of the senses will often connect more with that space emotionally than someone who has experienced that same space through only one sense. Each experience is unique and subjective, as two people can experience the same space completely differently based on how they use their senses, as well as how they feel at the time. It could also be related to the fact that each person

has different sensory requirements and therefore reacts to sensory environments differently, and uniquely. These differences are due to a number of reasons, largely including varying cultural practices and an understanding of space and interaction. (Bloomer 45, 59–68; Pallasmaa 17; Hall et al.; Reghukumar)

The senses all work in harmony with each other and send information to the brain simultaneously so they are often quite difficult to separate. The five senses tend to be considered in a hierarchal system. Vision was, and often still is, seen as the highest sense and touch the lowest. Vision and hearing are now often viewed as the primary senses. This is partially due to the fact that they do not alter nor consume that which is being sensed as they do not require direct contact; and because distance required for these senses can be significantly greater than the other

three senses. Smell, taste, and touch are viewed as archaic sensory remnants. They are more close-up and physical senses, in some cultures suppressed into purely private functions and rejected from acceptable interaction norms. This dominance of sight over the other senses has led to a significant bias in design. (Pallasmaa 15–16, 20–21; Bloomer 26).

The bias towards one vision over other senses, along with the separation of body and mind have led to an overall neglect and devaluation of the senses when it comes to design. The body is thought of by many architects as a standardised set of movements and measurements, when in reality the body is organic, ever-moving, constantly changing, and unique to each individual. The body in design is often portrayed as a static object, frozen in set poses or performing tasks in an emotionless, machine-like manner. This

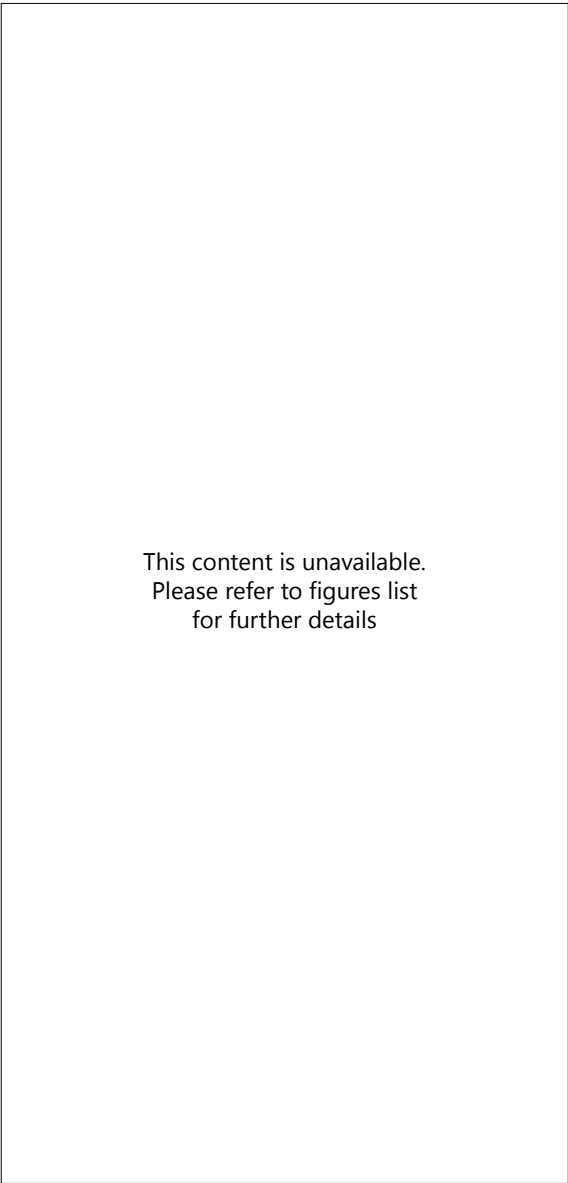
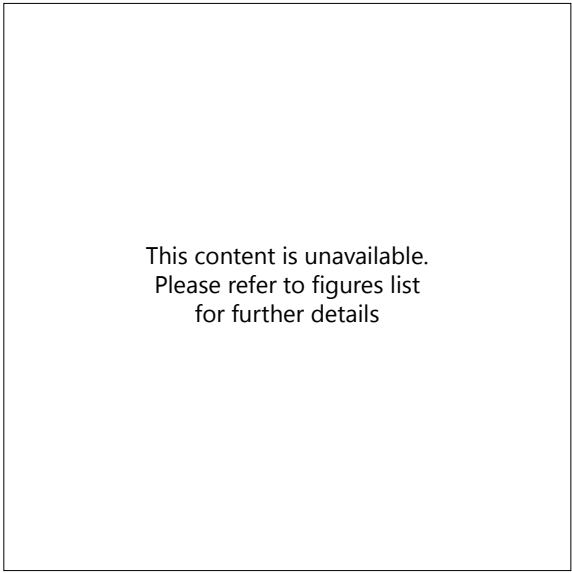
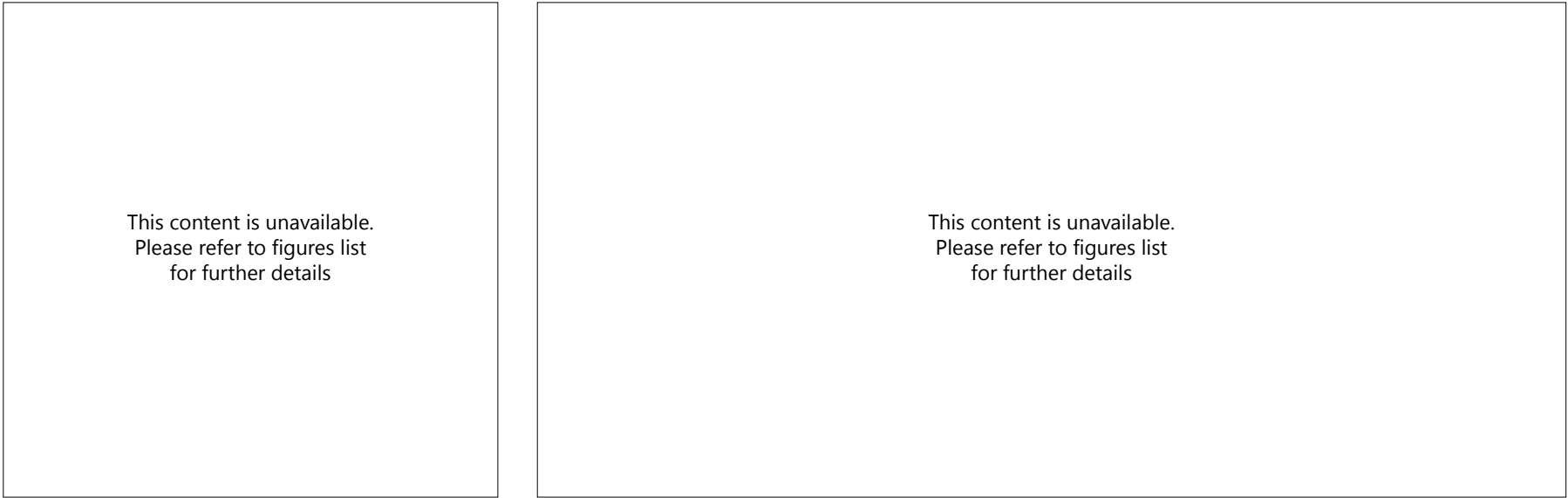
can be seen in ideas such as Le Corbusier's 'Modular' which neglected the qualities of movement and activity specific to the body, instead preferring to consider the body as a purely proportionate system. Despite the way that body and mind have been depicted and thought of as separate entities, they are very closely interconnected. Bodily movements are conducted with feeling and sensation. Each movement has the ability to provoke emotion and memory. Every activity and action evoke thought, emotion, and interactions. Architecture consists of elements that confront and interact with the body and mind, invoking memory of past actions or places. The body should therefore be considered as an active force within architecture, influencing design through how it senses and moves. Movement and body are constantly interacting with the environment. One cannot be separate from the other as the body always exists within a space. Body, mind, and architecture are inseparable and interdependent. They are the general medium in which the world is experienced, perceived, and reacted to. (Bloomer 28–29, 40; Franck and Lepori 14–15, 135; Pallasmaa 40, 63; Inglis 15; Huges-Hallett 48; Ibbotson 17, 35, 43–47, 139).

Engaging the body's sensate response to the physical environment and working to amplify the experience of the built form through activating the sensory impulses of both body and mind is introduced through Nigel Thrift's Theory of Affect. Usually associated with words such as emotion and feeling, Affect can be interpreted to mean many different things, though it is generally understood as a form of thinking in a way that is often indirect and non-reflective. Affective reactions can be created through many different elements of architecture. One of these elements is purely the surface itself. Materiality,

finish, shape, and composition including the horizontal and vertical orientation of surfaces can all yield various emotive responses. John Rajchman's discourse on ground discusses this further. Rajchman argues that horizontal planes such as the floor or ceiling can be used as an expressive element of architecture, and that engaging the horizontal plane and emphasising its surface has the ability to provoke movement and interaction, challenging the way in which the architecture is inhabited. Pushing the boundaries of the horizontal plane and defying the norm of how it usually takes form encourages a stronger dialogue between building, surface, and inhabitant. Current methods of communicating architecture also tend to be non-emotive. Architecture is usually portrayed in plans, sections and elevations – views that are rarely actually seen. Drawn in black and white lines on paper, these views do not show the experience of the occupant nearly as well as emotive drawings such as physical models or even perspective views rendered in colour can. Emotive modes of representing a space, its desired atmosphere and desired occupant experience can affect the way that the design itself evolves, more so than shapes and geometries on a page. It is also important to communicate how the occupant will feel within the space and how they will move through it, not just the function of the space. Form can begin to move and operate in more unpredictable and less systemic ways when the ground and orthogonal grid are no longer dictating or regulating the structure, and the architecture itself can become much more emotive and atmospheric. Working in a three-dimensional way is a method in which the boundaries and grid of the orthogonal can be pushed and challenged. Through the use of different methods of designing and the portrayal of the design elements in emotive and

atmospheric styles, the design itself should develop in a unique and more poignant manner. (Ibbotson 83, 137–39; Huges-Hallett 75, 118, 128, 188; Thrift 58–62; Rajchman 22–23, 106–107; Bloomer 105; Franck and Lepori 127–28, 132).



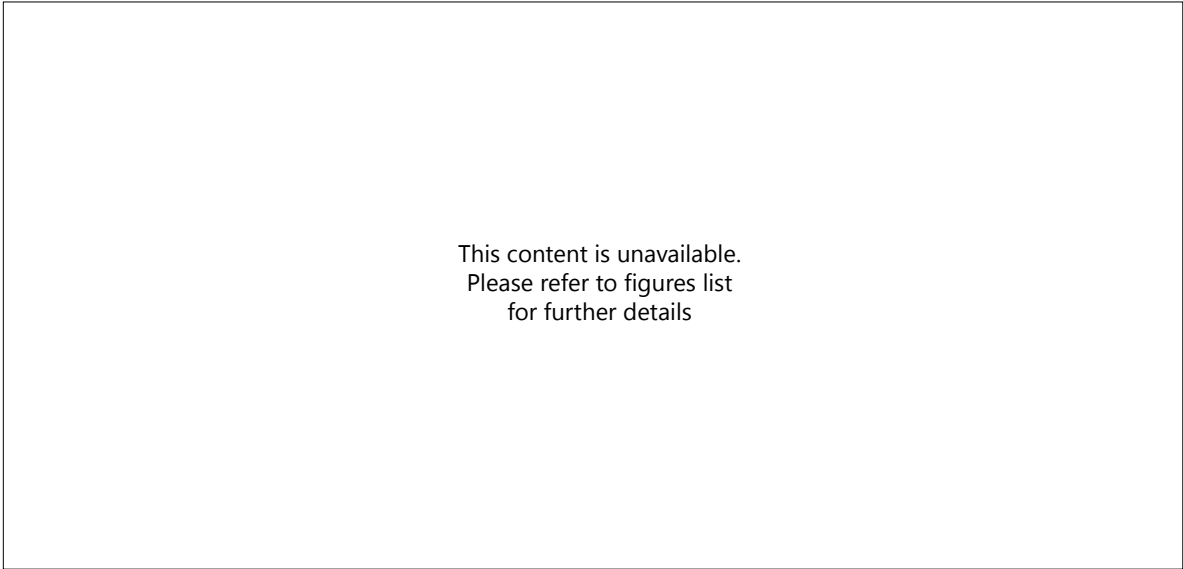


The KODA House is a model of tiny house from the company Kodashema OÜ, an architectural and engineering company, specialising in the creation of innovative living and housing solutions. Founded by Hannes Tamjärv and Ülar Mark, who is also the head architect, Kodesema uses innovative techniques and design to produce houses offsite, instead of the more traditional, slower, and labour intensive building methods. Because of this building method and their structure as free-standing compact houses, the KODA Houses are portable, and can be installed and uninstalled multiple times in multiple locations. KODA comes in multiple forms, ranging from the original concrete, to the lighter loft, which has both compacted and extended versions. All versions of KODA can be moved with its owner, and stacked or put together side-by-side, like building blocks, to build a larger house, added home office, or apartment complex. With each unit taking up only 30m2 of land each, the modular houses are quite versatile and can be located in a multitude of places, from inner city living, to more remote countryside spots.

KODA began with a concrete house of 26.2m2. Thin composite panels of concrete

form the exterior, with wooden panels for the interior, finished with natural oils and waxes, and built in adjustable LED lighting. With the entire front façade being four-ply glass, there is plenty of natural light into the open plan space, with a full sized sleeping area on a mezzanine level above a shower room and toilet.

The KODA Loft sticks with the original award winning layout, but with a new material palette over a steel reinforced timber structure. The change in building materials more than halves the weight of the Loft in comparison to its concrete counterpart. With an internal floorplan of 25.8m2, the KODA Loft is much easier to move to remote locations, as well as placed on an inner city lot. The KODA loft can support up to two units of its own kind stacked on its roof, and exterior finishes can be altered to suit the occupants and personalise the homes appearance somewhat. Interior elements can also be altered to suit the environment and functionality of the unit. The KODA units have fully equipped kitchens, and plenty of storage, considering their tiny footprint. This footprint can be extended however, or even compacted, with the KODA compact measuring a mere 20m2, the



KODA Compact extended, which, at 35m2, follows the same footprint as the Compact model, but with a bedroom in the rear, and the KODA Loft Extended. The KODA Loft Extended has a footprint of 45.8m2 making it too large for this study, however there are a few images included for the techniques that were used within these units to save space, and make the unit feel larger than it is.

(‘KODA by Kodashema’)

Figures.16-26:KODA interior and exterior images





Three different KODA floorplans were examined and analysed. From this some visual tricks and layout elements were pulled out. Some of these design features are successful; some less so. Many of these are in line with the findings from chapter 2. It is useful to note the elements of the design that were utilised as well as the footprint and volume of the space as these can aid and inspire elements in further stages of the research.

As KODA is only a base for the experiments run in this chapter to find the key criteria before actually designing; it is not crucial to redo the layout. However, if changes were being made to the layout, some areas would be re-arranged such as locations of bathroom openings. This line of thought can be seen in blue pen in the images to the right.



Figure.27:Authors analysis of KODA Concrete model

Figure.28:Authors analysis of KODA Compact model

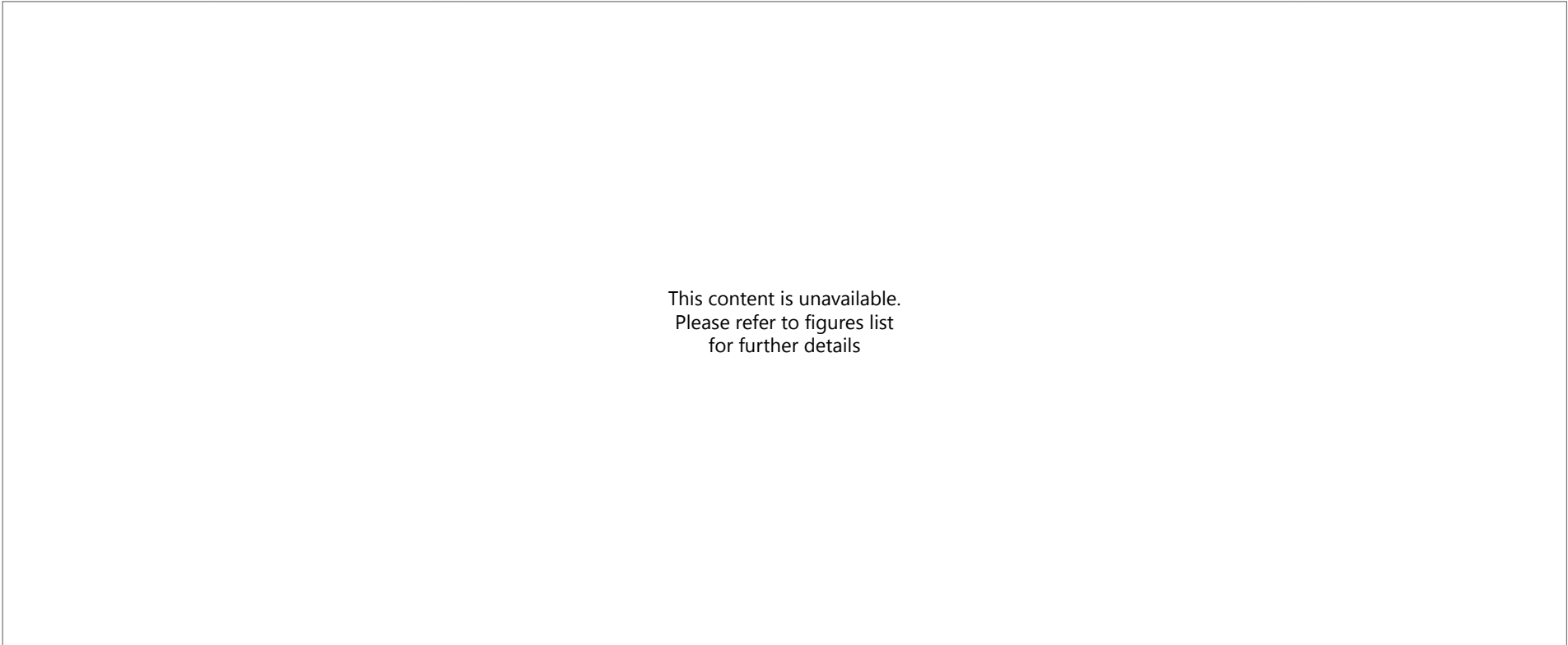
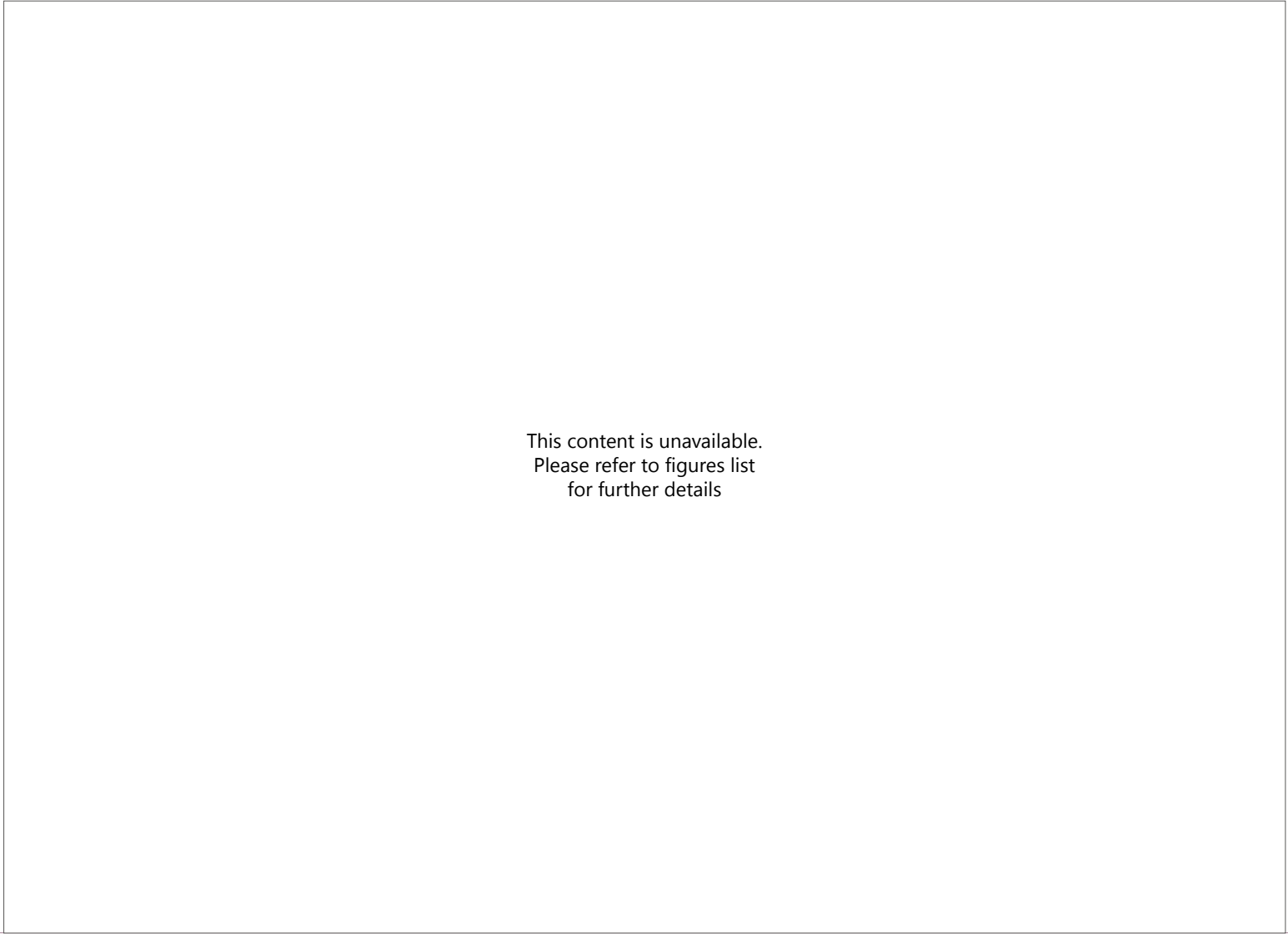
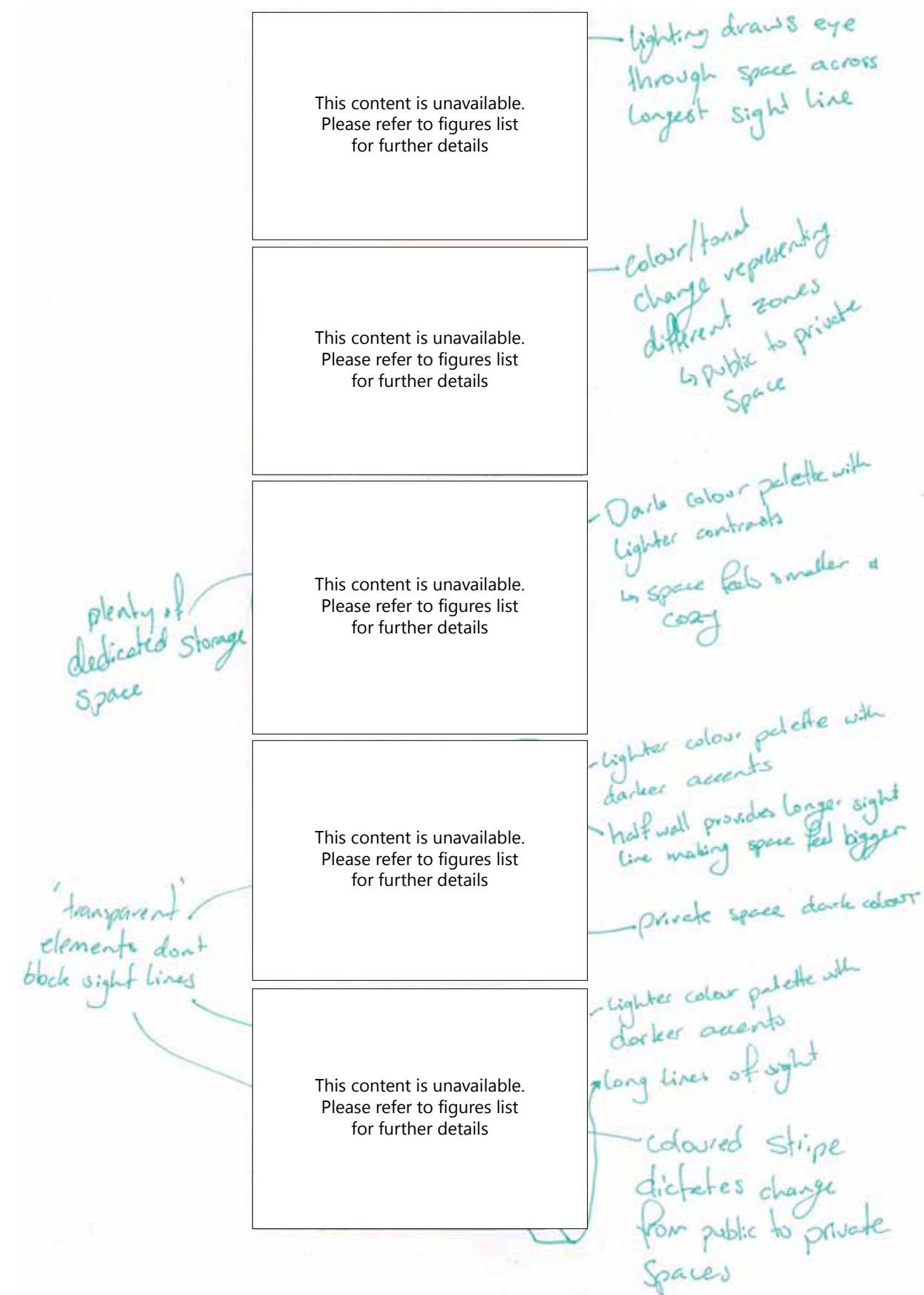
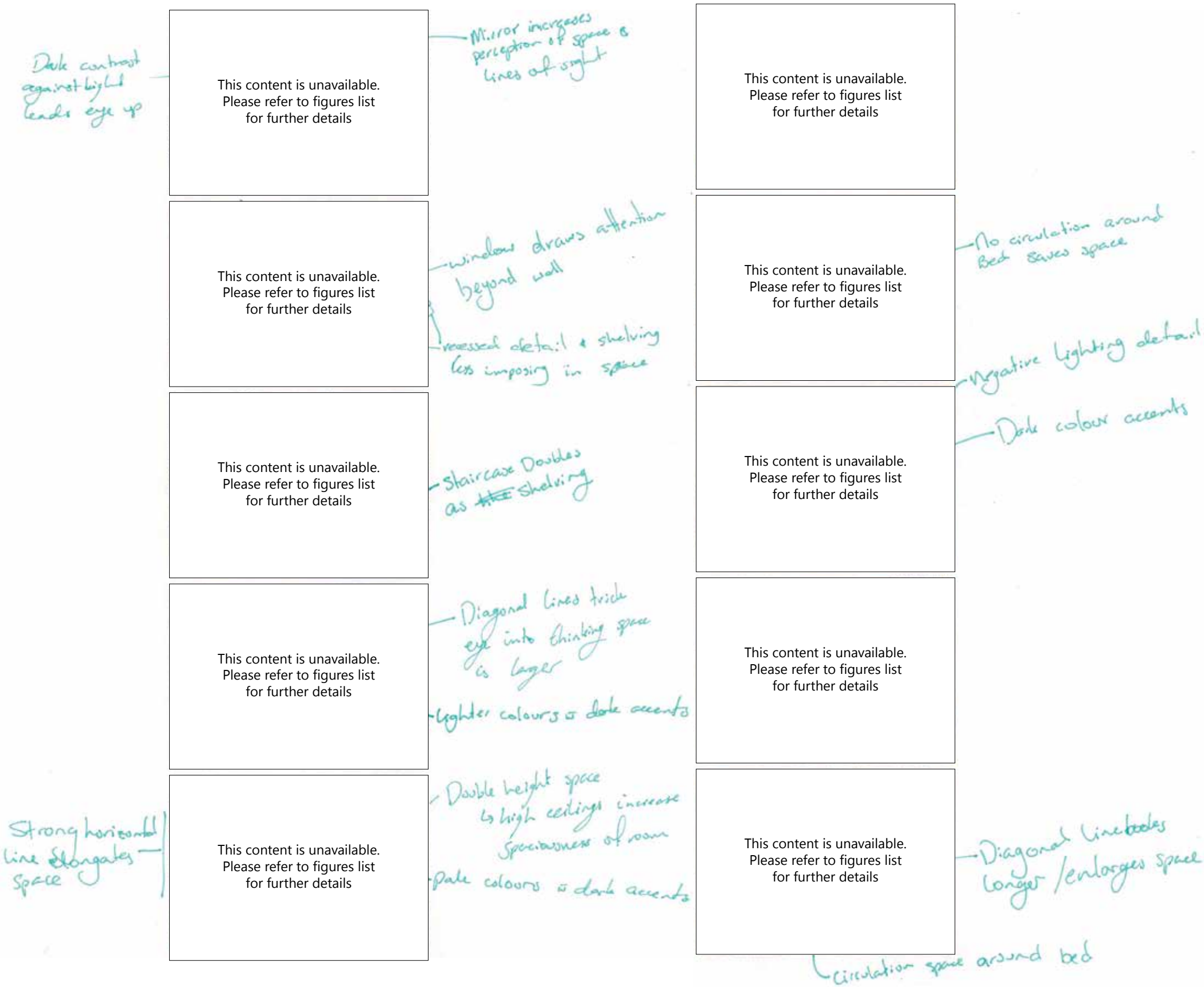


Figure.29:Authors analysis of KODA Compact Extended model



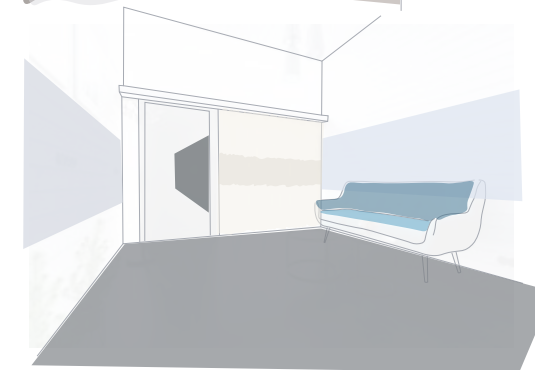
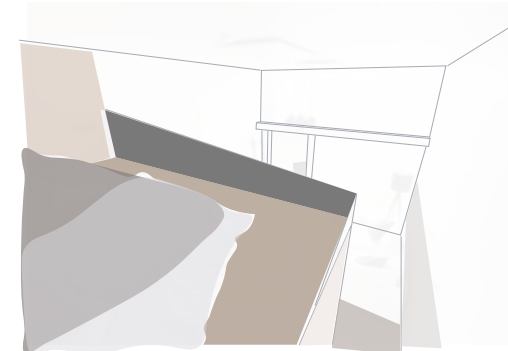
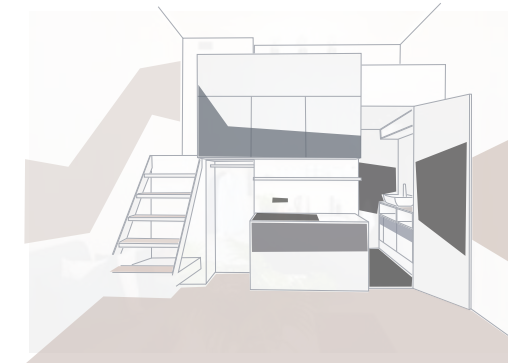


Images of various KODA interiors were printed out and analysed in the same way as the plans and sections on the previous page. Visual tricks and elements were the key elements looked for.  
Figures.30-33



This series of drawings looks at KODA in its existing conditions and pulls out the key visual tricks that were employed to make the space feel larger. These include;

- Lighter colour palette with dark accents
- Windows at the back of a space drawing the eye through
- Recessed/negative details
- Strong horizontal and diagonal lines drawing the eye through space and elongating sight lines
- Double height space
- Lighting highlighting longest line
- Changes in colour or material to indicate a transition from public to private space
- Darker colour palette in spaces that are wanted to feel more cozy



This series of drawings looks at the existing conditions of KODA in a tactile sense.

Most commonly touched areas are highlighted with blocks of colour. It quickly became obvious that KODA was not designed as a tactile experience, as the majority of surfaces within are hard and flat, often cool to the touch, and inflexible/unchanging when pressure is applied to them. These materials include plywood, powder-coated or polished metal, concrete, and laminate. The only softer materials are in temporary furnishing such as beds, curtains, and couches.



# Touch

‘Everything is an event on the skin’ – Helmholtz

The sense of touch, which includes the haptic system, is traditionally divided into the five sensations of warmth, cold, pressure, pain, and kinesthesia which is the sensibility to motion. Touch can however detect many more properties of an object such as weight, texture, density, moisture, and vibration. Touch is arguably the most physical of all the senses with some properties being perceptible only through direct contact with the skin. Some properties can be conveyed through the medium of air, but these are limited and often only at close range. Touch works via information being collected through the skin and the hair on its surface. Under the skin there are nerve endings which send the information through the nerve as a neural impulse to the brain. Nerve endings are unevenly spread across the body, and different types of nerve endings are more receptive to certain types of stimuli than others. Because of this, certain areas of the body are more sensitive than other parts of the body. For example, there are more nerve endings per centimetre in the human foot than anywhere else in the body resulting in it being one of the most sensitive areas. The connection between the body and ground is therefore a critical consideration. (Solon

26–27; Pallasmaa 41–42, 56–58; Bloomer 33–35; Reghukumar; ‘FEET FACTS’).

The skin forms the outline of the body, the barrier between it and the world. It is the first layer of the environment inhabited, and the primary sensory surface through which the world is physically perceived. This makes situations where bare skin is touched far more intimate and primal, eliciting stronger emotive responses. Skin is flexible and changing, able to distort itself against different surfaces; strongly contrasting with the hard, unmoving, and static forms that so often make up architecture. (Huges-Hallett 18, 36, 128; Ibbotson 9). For the purpose of this research, the experiments and the design that tests the resulting framework are carried out under the assumption that the occupants of a space are experiencing the tactile nature of it with bare skin so that they will fully experience the effect of designing for touch by using tactile methods.

Though most interactions with the environment are experienced across multiple senses, with spaces being interpreted and measured equally by the skin, ear, nose, and eye in collaboration

with one another, the tactile sense is a key element in the sensory perception of an environment and can be utilised to create and define a space. Only touch has the distinct ability to alter the environment in the process of perceiving it and to interact so directly with the physical world. The tactile sense approaches and feels the environment through many techniques such as variation and complexity of textures or changing temperatures and materials. Contrasting volumes within a space can also often be felt as perceived touch, as the proximity of an object can be felt, often alongside sight. This means a change in volume can evoke feelings of openness or enclosure and can act as a boundary between spaces. Touch is analytic, and according to Rene Descartes, is a more certain sense than vision, and less vulnerable to error. Touch is extremely important for people with visual or hearing impairments, which is why it is often used to aid them for education and orientation. As people who have a lessened sense of sight often cannot see shades or colours, they rely on touch to sense the surface textures and edges of objects. This becomes a key tool in helping with navigation. For those with an impairment to their sense of hearing,

touch can help them to feel sound through the vibrations in surfaces, allowing them to feel what they cannot hear. (Bloomer 33–35; Pallasmaa 19, 41–42; Ryhl 118; Celani et al. 161; Reghukumar).

Touch has a large part to play in the way that people move around a space; their bodies and movements dictated by the haptic sense. Both the tactile qualities of a space and the haptic memory have the ability to choreograph how people move through a space. Changes in texture or material are often used as signals for special events or changes in the way one should act within space, although contextual clues are also given through the purpose of the space. Smooth surfaces can encourage touch and close contact. A rough material pallet, however, can urge people to move more carefully and tentatively, not wanting to damage their belongings or person, or could have people wanting to reach out and feel the tactile qualities of the surface. (Bloomer 71; Pallasmaa 60–62). Tactile qualities of a space can have a strong influence on the emotions of its occupants, so these are an important element to look into further.



Figures.36-37: Author's own drawing depicting a blast of air alerting a person that a threshold between one space and another is being crossed.



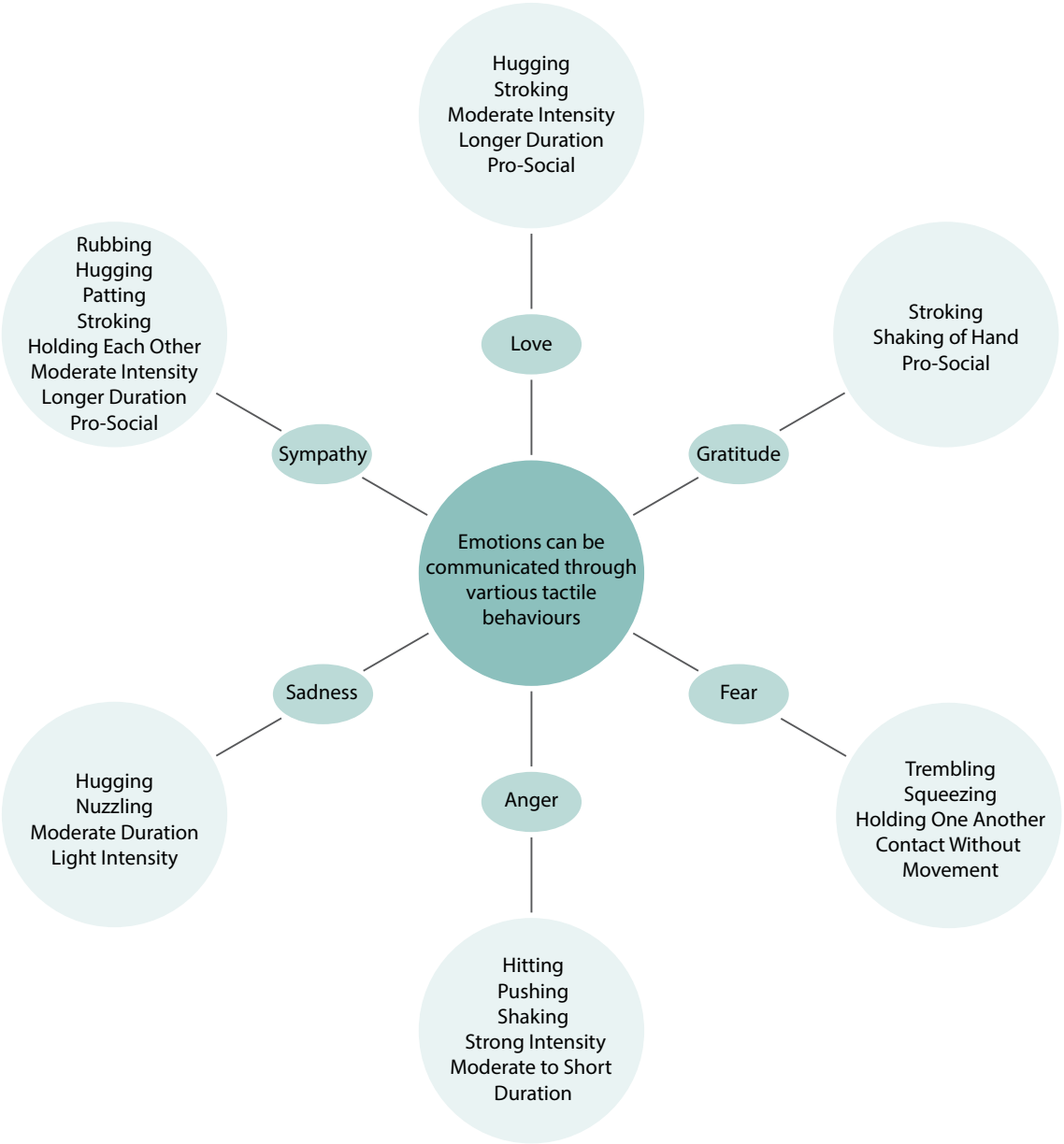
## Emotion through Touch

Emotions influence a great deal of people's lives, so they play a very important role. How the world is perceived and the decisions that are made, as well as communication and interactions between people, are heavily guided by emotion. There are many nonverbal channels utilised to convey emotion and distinct messages. These channels can be used both simultaneously or individually. Some nonverbal channels are favoured over others to communicate different emotions, the most effective of these are body, face, and touch. The sense of touch, or the haptic channel, can be used to communicate the hedonic tone of an emotion, be it positive or negative, as well as increasing the intensity of the emotion. It can communicate several emotions such as sympathy, love, gratitude, happiness, fear, anger, sadness, and disgust. These are able to be recognised on the basis of the type of touch, of which the rates of recognition of the emotion communicated are comparable to the rate at which emotions can be conveyed through facial expression, and verbal communication. (Tsalamlal et al. 69–73; Hertenstein, Keltner, et al.; Hertenstein, Holmes, et al.). This can be applied to the realm of interior architecture through the types of materials and surfaces used. Using materials and surfaces that are soft and smooth create a more pleasant atmosphere and communicate more positive emotions. Surfaces that seem to hug the body or touch the skin in a positive manner would also help to produce an enjoyable environment.

Distinct emotions can be portrayed between two people entirely through the tactile experience; even just touching the forearm of another person can reveal different emotions. Certain aspects of emotion can also be communicated through elements of the atmosphere such as various textures or controlled blasts of air. As the tactile system is very complex, there

are specific patterns and physical features used in this form of communication to dictate specific emotions, with systematic differences between the types of touch in relation to the specific emotion. There are certain factors that are crucial in the communication of emotion through touch. These variables include the specific actions used, the location and duration of the touch, the intensity or force of the tactile patterns, and the velocity of the movement across the skin. Lower intensity and slower movements have been shown to be more pleasant than higher velocity or static movements. Touches from soft and smooth-surfaced materials are known to be more pleasant than those with an abrasive, rough, or stiff surface. A higher force behind the touch decreases pleasantness. Some tactile behaviours and signals can be used to communicate multiple emotions depending on the intensity and duration of the touch, as well as the other forms of touch used simultaneously. (Tsalamlal et al. 72–76; Hertenstein, Keltner, et al.; Hertenstein, Holmes, et al.). This can be applied to the realm of interior architecture through the types of materials and surfaces used. Using materials and surfaces that are soft and smooth create a more pleasant atmosphere and communicate more positive emotions. Surfaces that seem to hug the body or touch the skin in a positive manner would also help to produce an enjoyable environment.

Figure.38:A few of the tactile behaviours that can evoke emotion



Lucy McRae

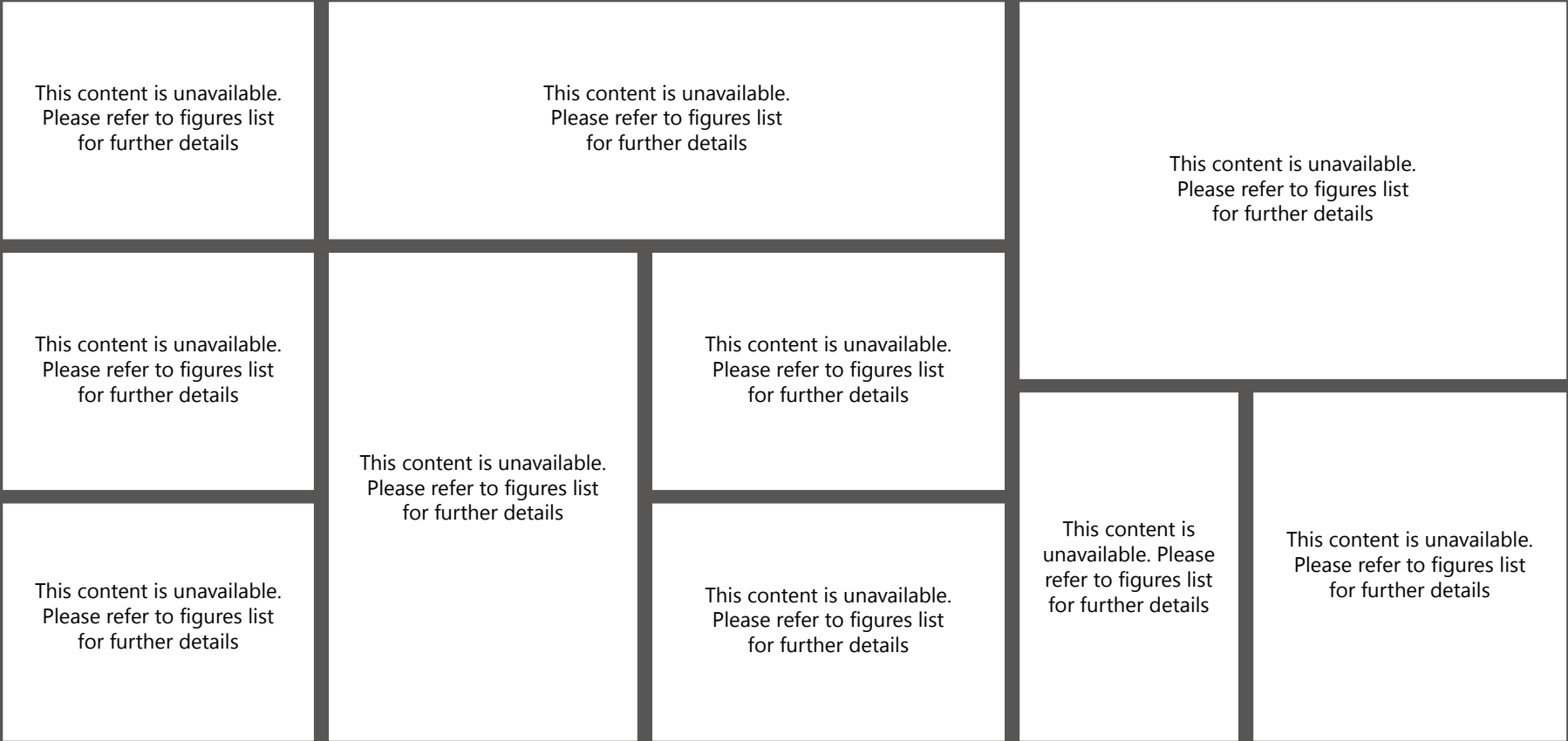
Artist, Body Architect, Inventor, Filmmaker

Lucy McRae works over multiple disciplines, and blurs boundaries between explores the limits of the body, beauty, and self. Her work provokes ideologies and ethics, and delves into who we are and where we are headed as a species with the cultural and emotional impacts of science and new technology. Her interdisciplinary work disregards labels, and spreads across architecture, design, art, and technology. She builds structures on the body, or that encompass it tightly, redefining the silhouette. McRae is interested in the space between the body and the surrounding environment around it, as well as the space between the body and the clothes upon it. This is shown in her work ‘Body Silhouettes’ which reshape the human form through pressure from technology, raw emotion, and the natural environment. In an interview she talked about communication through smell, and how this being lost through evolution, becoming increasingly alienated from human instinctual processes. As she works with science strongly within many of her processes, there is a lot of research that goes into many o her ideas and concepts.

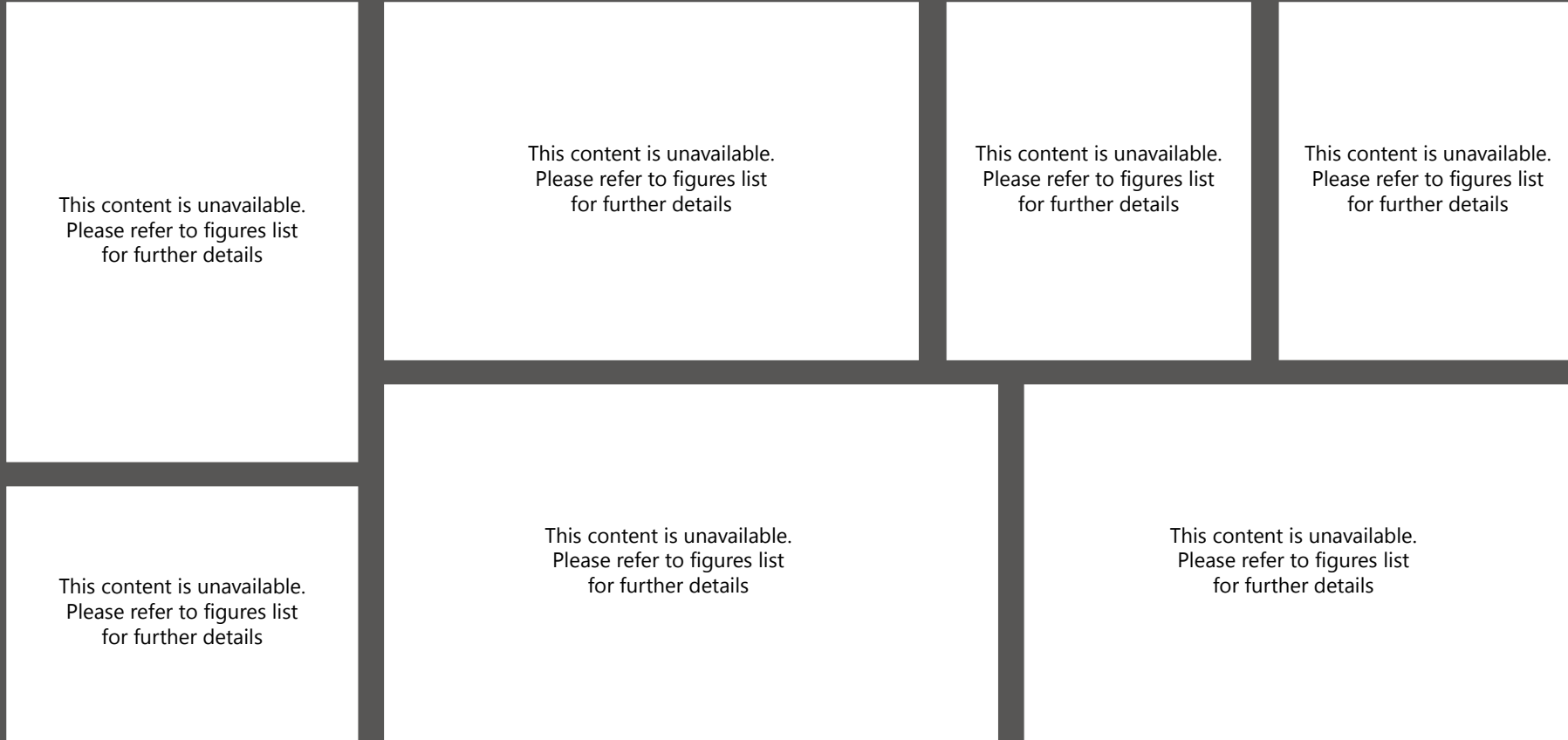
feeling of being hugged is also simulated through a mart-machine, part-human process within ‘Future Day Spa’ that induce a state of relaxation in the body. ‘Astronaut Aerobics’ is another immersive experience. One in which audiences claimed that the experience had “put their body back into place” and was like “being hugged by a machine.”

(‘World Renowned Science Fiction Artist and Body Architect Connects Science with Imagination — World Renowned Sci Fi Artist and Body Architect’; Sellars)

Some of her design and artwork can be seen in the images above. ‘Compression Cradle’ works through the choreography of touch sensations. A machine that affectionately squeezes the body, assisting in the alteration of the levels of oxytocin expressed. Through a sequence of aerated volumes that hold the person within the cradle tight, the hormone is released in the brain that is responsible for building trust and pair bonding. This



Figures.39-48:Artwork and Installations by Lucy McRae



Figures.49-55:Wasteland Exhibition

## ‘Wasteland - From Waste to Architecture’

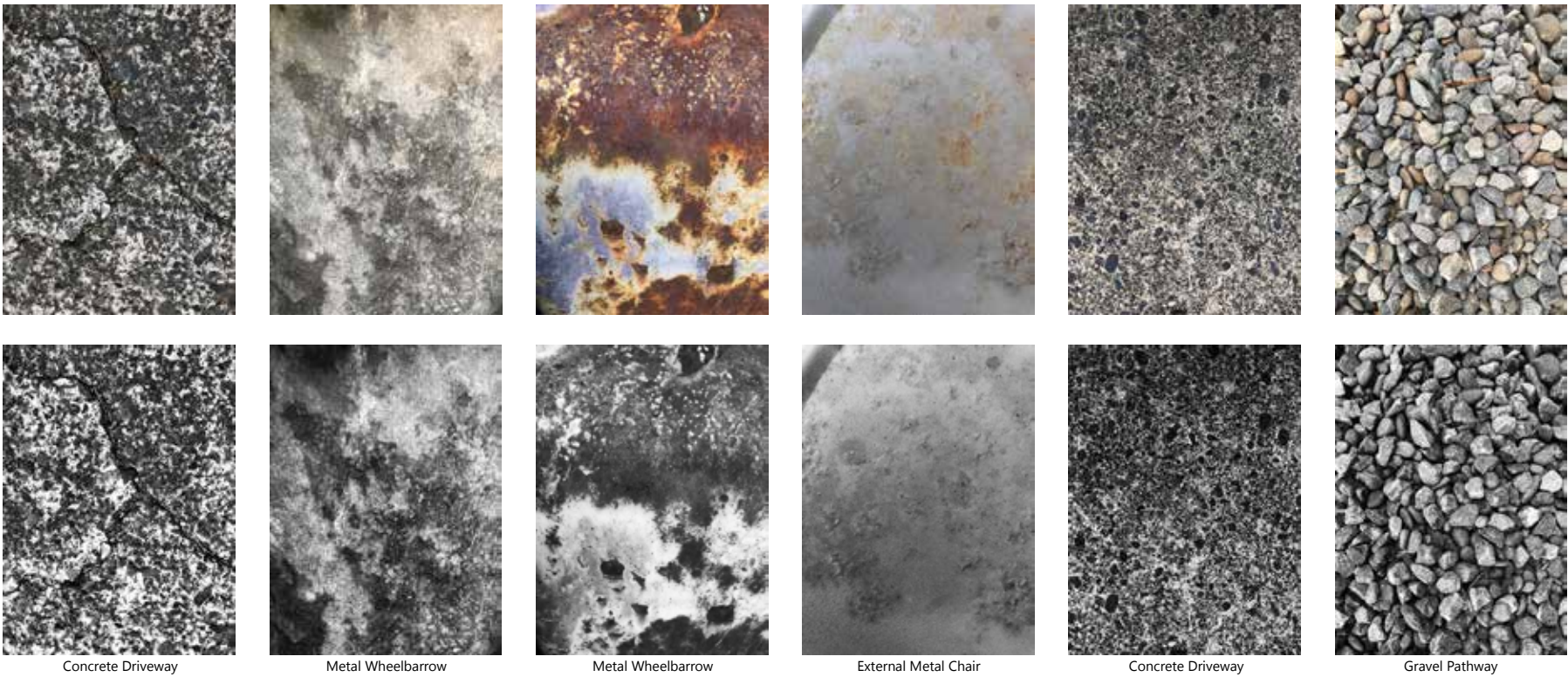
Danish Architecture Centre, Copenhagen, Denmark

Set up by Anders Lendager, architect and director of the Lendager group, the exhibition has a strong focus on ‘up-cycling construction waste. Up-cycling is recycling and upgrading materials so that they are more valuable than in their previous form. The Wasteland exhibition provides a very tactile way of understanding the realm of up-cycling in architecture, to bring to the forefront the message that waste can be used to build houses. Providing an architectural response towards issues of increasing urban migration, population, and climate change, Wasteland begins with an entry over a pile of crushed concrete. This is so that as you enter the exhibition you know immediately what it is about as you feel it underneath you. The entire exhibition is filled with stories of up-cycling materials, and is divided into six sections that are each separated and announced by large piles of ‘waste’ on the ground in front of their respective materials. The sections are wood, brick, plastic, concrete, glass, and steel. The exhibits in wasteland are filled with materials that lay on tables in their respective categories in a range of different forms; from raw materials, various levels of processed forms, experiments and methods, and in their final forms as used in projects. Each material category is paired with a building project showing some of the functional and aesthetic qualities that can come from different means of processing and reinventing ‘waste materials’. Almost everything within the exhibition can be held, smelled, stroked; the sense of touch being at the forefront of the format of the

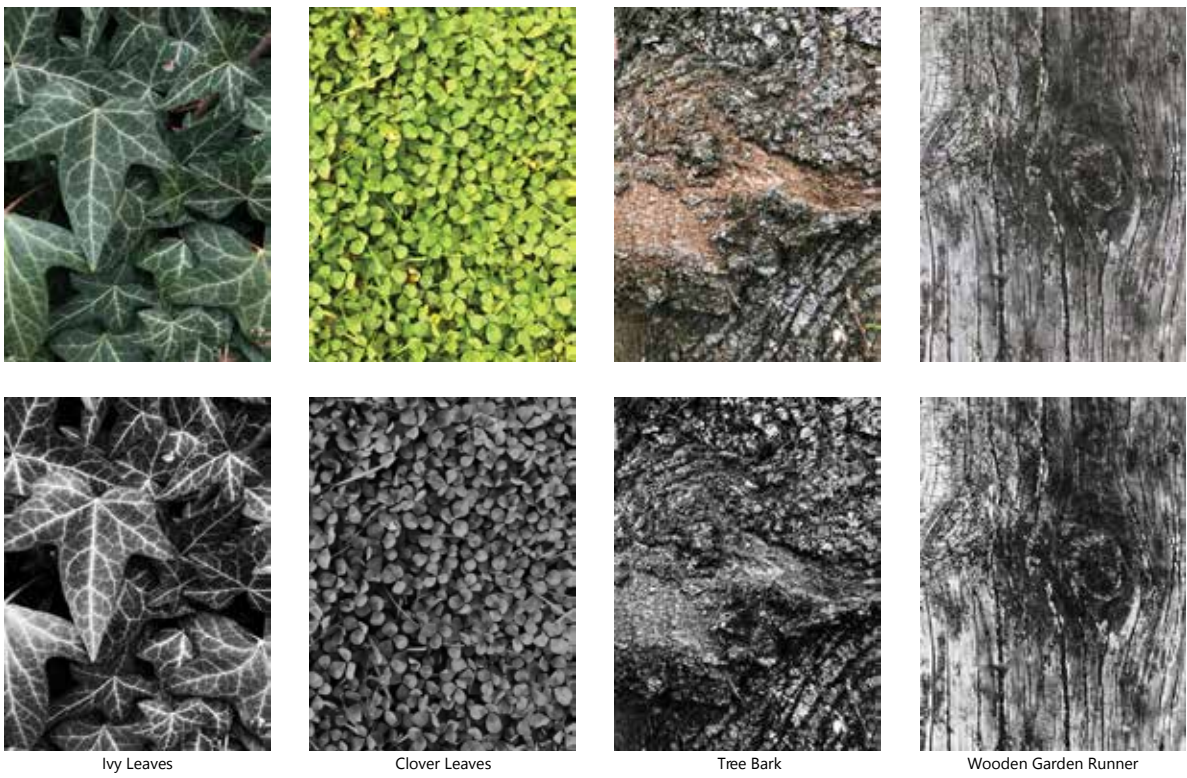
display. This format is unlike the typical exhibition space, and engages its visitors with the processes of transformation that it conveys. (‘WASTELAND-EXHIBITION’; Zilliacus; Jacobsen)

Wasteland’s heavy focus on the tactile elements makes it quite a good precedent for the touch element of this chapter. The method of touching and interacting with the elements of the exhibition, as a way to understand the information, strengthens the idea that all of the senses are important to consider in design, and that designing for touch provides a beneficial element in understanding the information being communicated. It also demonstrates how many tactile qualities can be produced through a select number of materials when they are treated and processed differently.

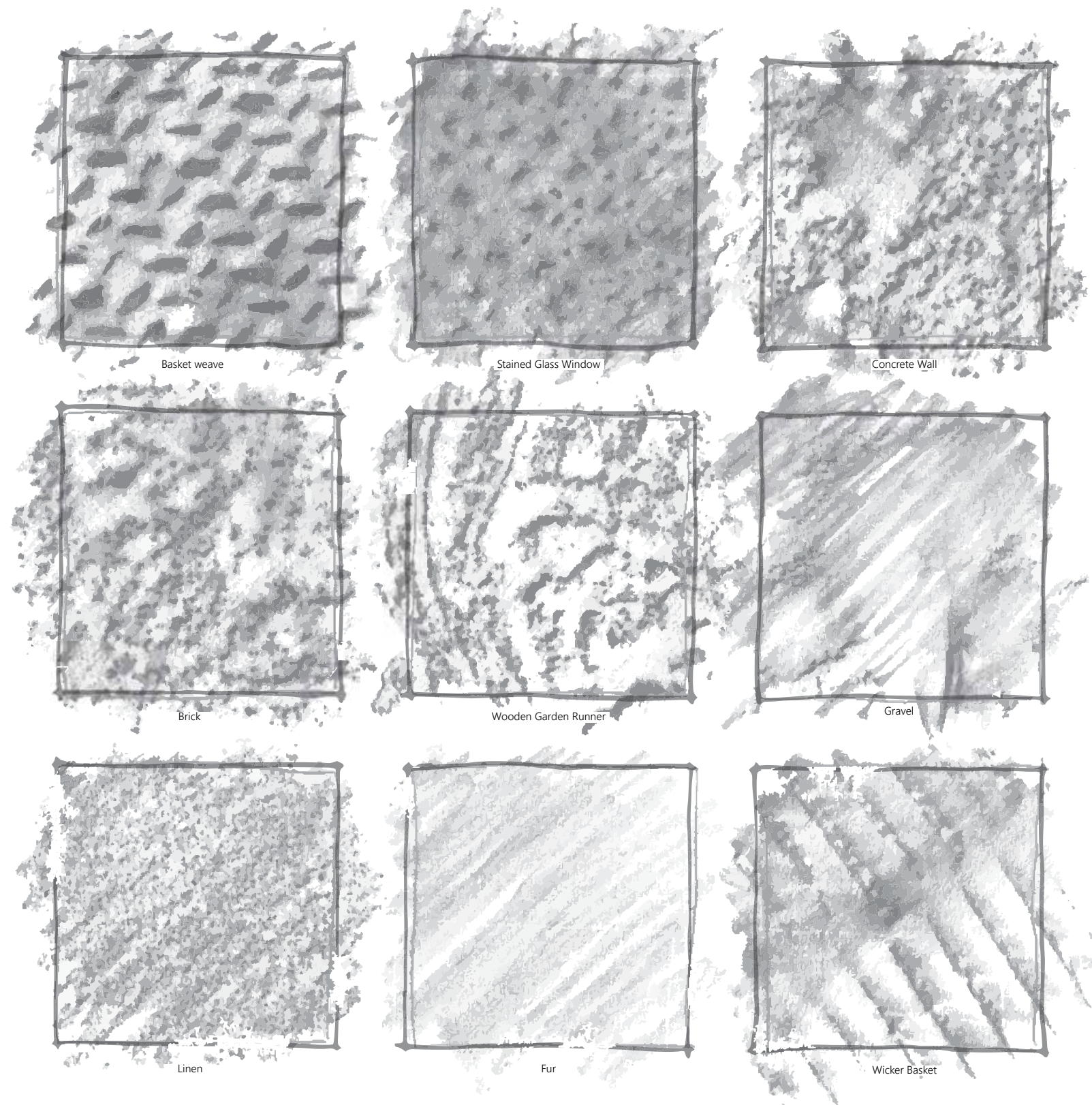




To begin the explorations into touch and texture, photographs were taken of different materials found commonly around a home. These were then changed into greyscale with the contrast increased. This gave a good first impression of the textures, and an introduction into understanding the individual textures of a material. It is worth noting, however, that colour still played a large role in the photos, with more saturated colours showing up darker in the black and white version. This made the textures themselves slightly harder to distinguish from simple colour variations. Because of this, the next step would be to remove any differences in colour and tone, focusing entirely on the surface texture.







This next step was done by taking pencil rubbings of some of these same materials. This took out all colour and focused solely on the texture and patterns formed by the surface of the material. The results were impacted by the flexibility of the paper resulting in some finer details being missed.



As a response to the difficulties found from the pencil rubbings, clay pressings of different materials were taken. These show texture clearly and without colour or any other visual aspects. The pressings show detail and depth much better, as well as shadows created. The clay impressions are more accurate and significantly more tactile.

# Yves Klein

Anthropometrie

Yves Klein was a French artist during the mid 20th century. He was well known for scandalizing the public with provocations that seemed to propel his career. Bernadette Allain, his long-time companion and collaborator says of him;

“He had an amazing ability to live in the imaginary. Perhaps in a very infantile way, but he really lived it.”

The key example of Klein’s daring that is relevant for this area of research is his studies on anthrometries in blue as seen above. First performed on the 5th of June 1958, in a private soiree on Ile St-Louis, attended by around 40 guests, journalists, and collectors; all attendees wore formal evening wear. This was a stark contrast to the 20-minute performance itself, in which the models were nude. Using the naked female form as a paint brush, the main model, Marlene, would smear herself in Klein’s signature blue paint, before undulating her body across a piece of white paper placed either on the floor or wall. Klein would give strict instructions to the model in which movements and directions to take, and how to place her body, and had been working with Marlene and another model before this public debut. The performance raised many questions about provocation and good taste. Klein continued to work in private for another two years, with many different models, experimenting with this method of painting. (Banai; Works - Yves Klein)

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Figures.59-62:Artwork and Performance by Yves Klein

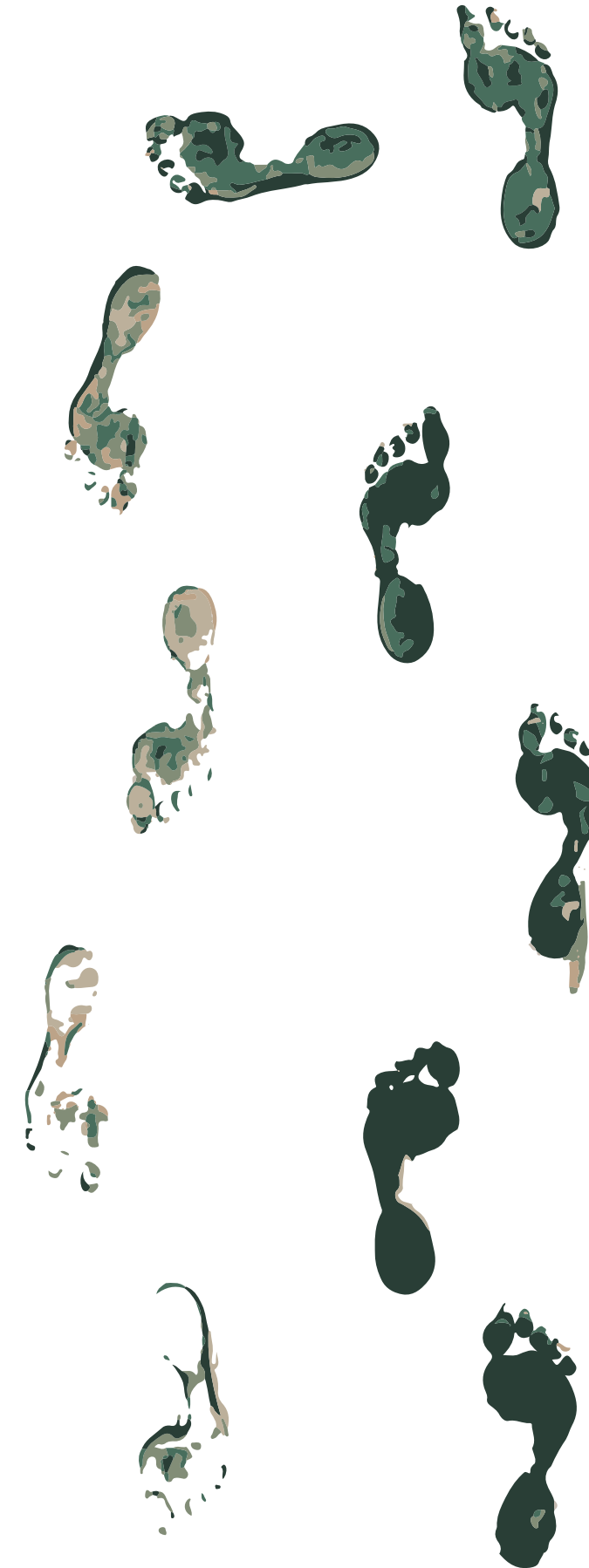


The works of Yves Klein are relevant to this research through touch and traces left. The trace from the body touching the paper, and the voids of colour left from the models' natural curves. Using the model and her figure as the paint brush means that the work cannot be achieved without touch – the paint on her skin, then her onto the paper.

Some experimentation was done in order to better understand and analyse the sense of touch, and the traces left behind. Through painting ones own extremities and making prints on white paper, unique markings are left that show variations in depth of colour, and also in shape, as the pressure points and curves are unique to the individual. The thickness in which the paint was applied would have some effect on the depth of colour as well as the key areas in which the majority of pressure was applied.

As can be seen in the prints on the right, more fleshy parts of the hand flatten somewhat to allow a flat print, however the hollows and natural curves leave some parts of the page white, obscuring the true form of the hand. The same goes for the foot, with the arch being left white, and only the ball, heel, and pads of the toes leaving a paint impression on the page.

The body could only deform itself so much against the hard surface, leaving voids in the colour. These voids can also lend themselves to showing the form of the limb as a negative. The areas that do not come in contact. This raises questions about how different materials will have different interactions between its surface and that of the extremity it is touching.



In an exploration of the relationship between the foot and the ground, the soles of the feet were painted and a piece of paper on a hard floor was walked across.

This experiment successfully displays the parts of the feet that come into contact with a hard surface whilst walking barefoot as well as the pressure points. The way that the paint wears off around the toes, ball, and heel of the foot shows that these are the areas that contact the floor most, with the arch of the foot leaving little to no trace.

The movement of foot during the interaction with the floor are not displayed through this method of experimentation. The reaction of the surface under the pressure of the foot is not captured either.



A distinctive outline of the foot was created as a byproduct of the previous experiment. This highlighted the areas of the foot that did not touch the ground while walking on a hard surface, so the process was repeated with both feet. Though useful, this exploration did not show the movement of the foot nor the floor during the interaction either. Another level of exploration was required. The next set of experiments serves this purpose.



This experiment used the hand to explore how applying pressure would change the surface of different materials. This is displayed in the images to the right. From left to right there is a bed, a velvet upholstered couch, a leather upholstered couch, and a wooden laminate table. This order also depicts the ease in which the material changed form as well as how much the surface was actually able to distort itself.

The next step within this experiment was to explore the interaction of foot and surface while walking. Two of the surface materials used were replaced for this. The following pages show this interaction.



Figure.66

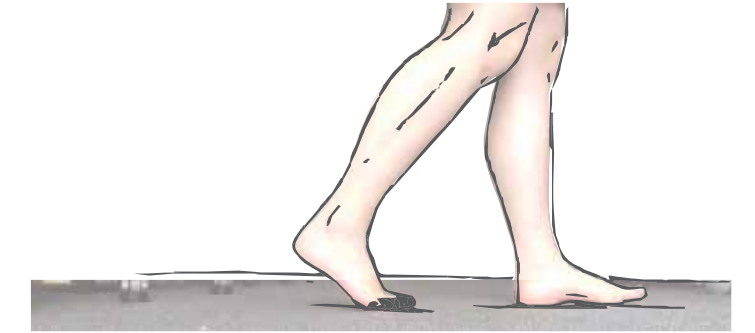
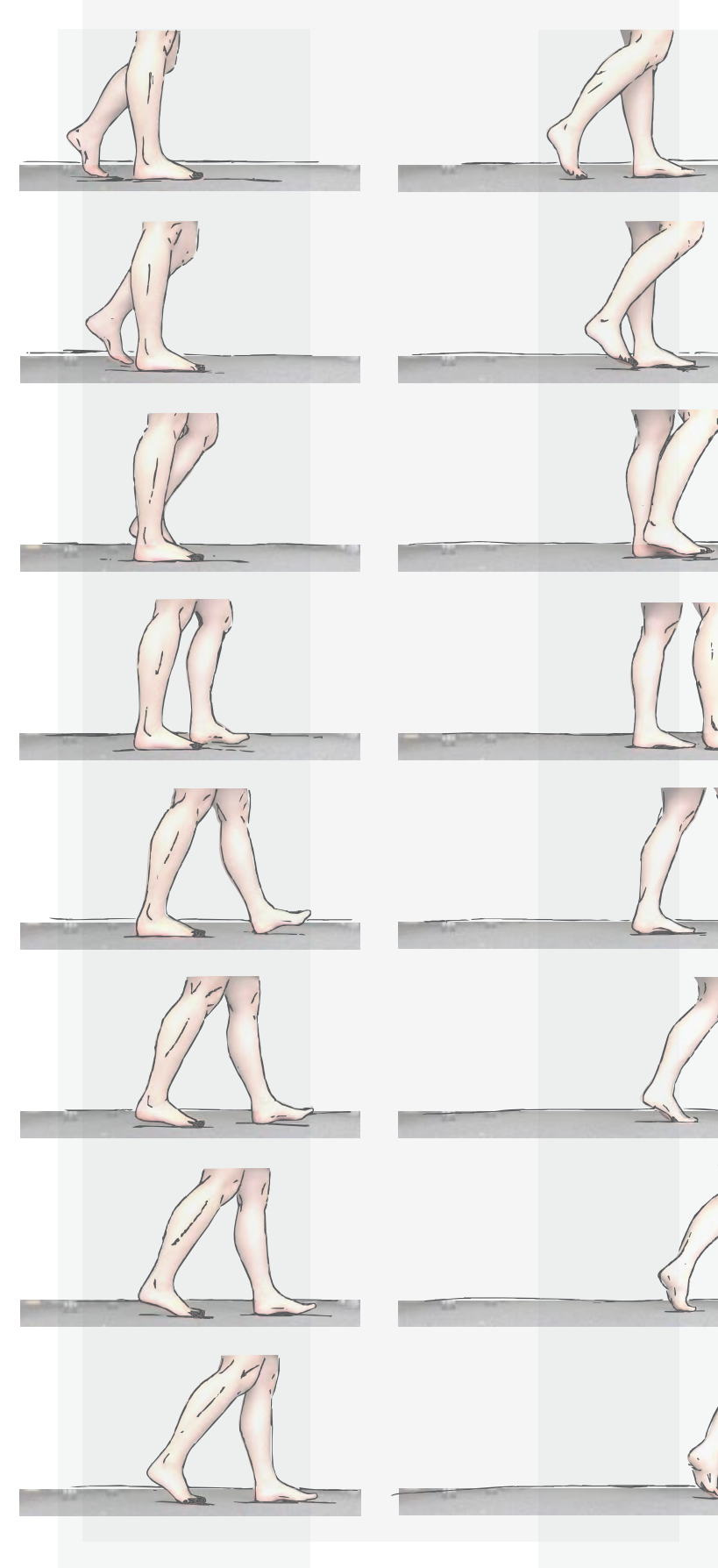


#### Walk on Linoleum

There was no change to the surface, with the foot flattening as it was the softer of the two materials. Partial physical contact on the base of the foot with the floor.

The lino flooring felt cold, flat, and smooth underfoot. There was little to no noise made, with only a quiet padding when the foot came into contact with the floor. It was easy to walk on.

Figure.67



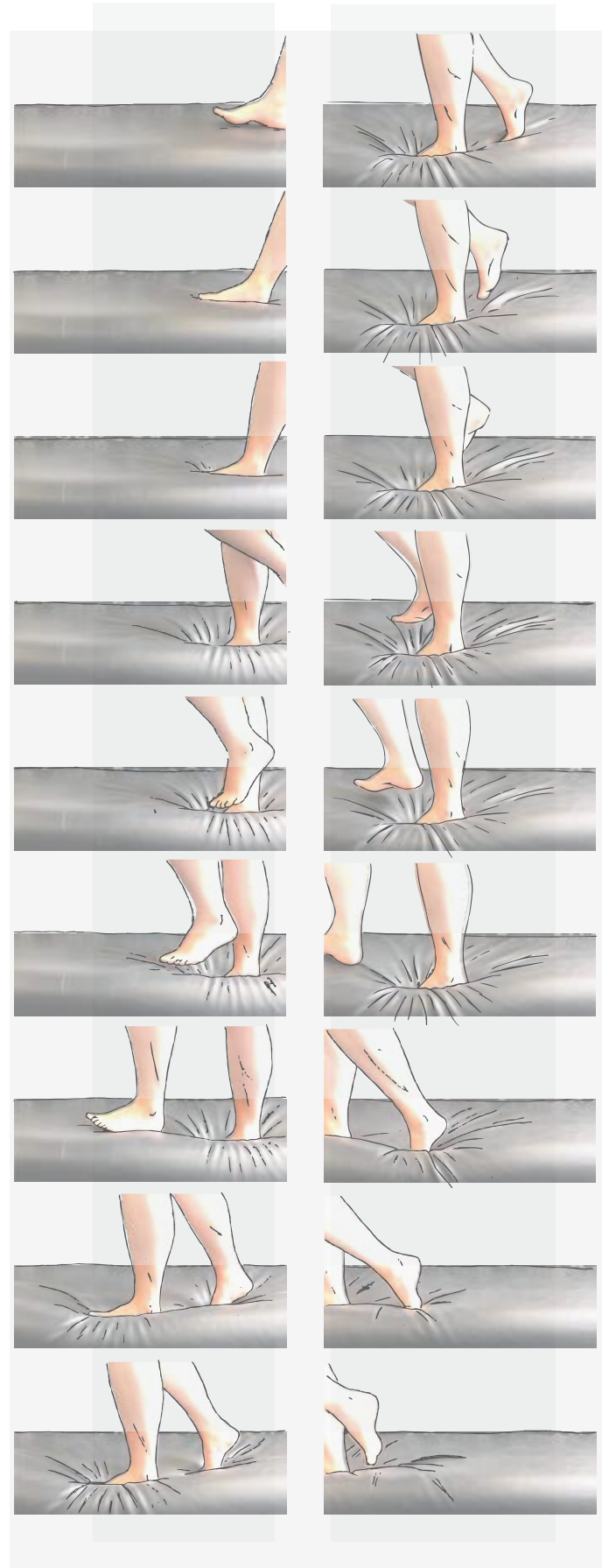
#### Walk on carpet

There was minimal change to the surface, with the foot flattening as it was again the softer of the two materials. Partial physical contact on the base of the foot with the floor.

The carpet felt warm and coarse underfoot. There was no noise made when the foot came into contact with the floor. It was easy to walk on.

Figure.68



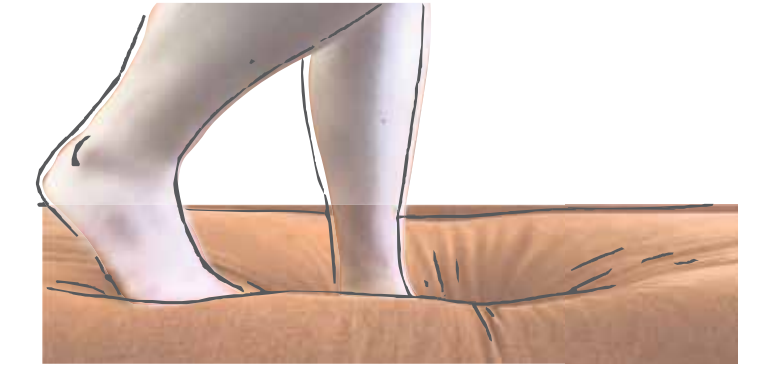
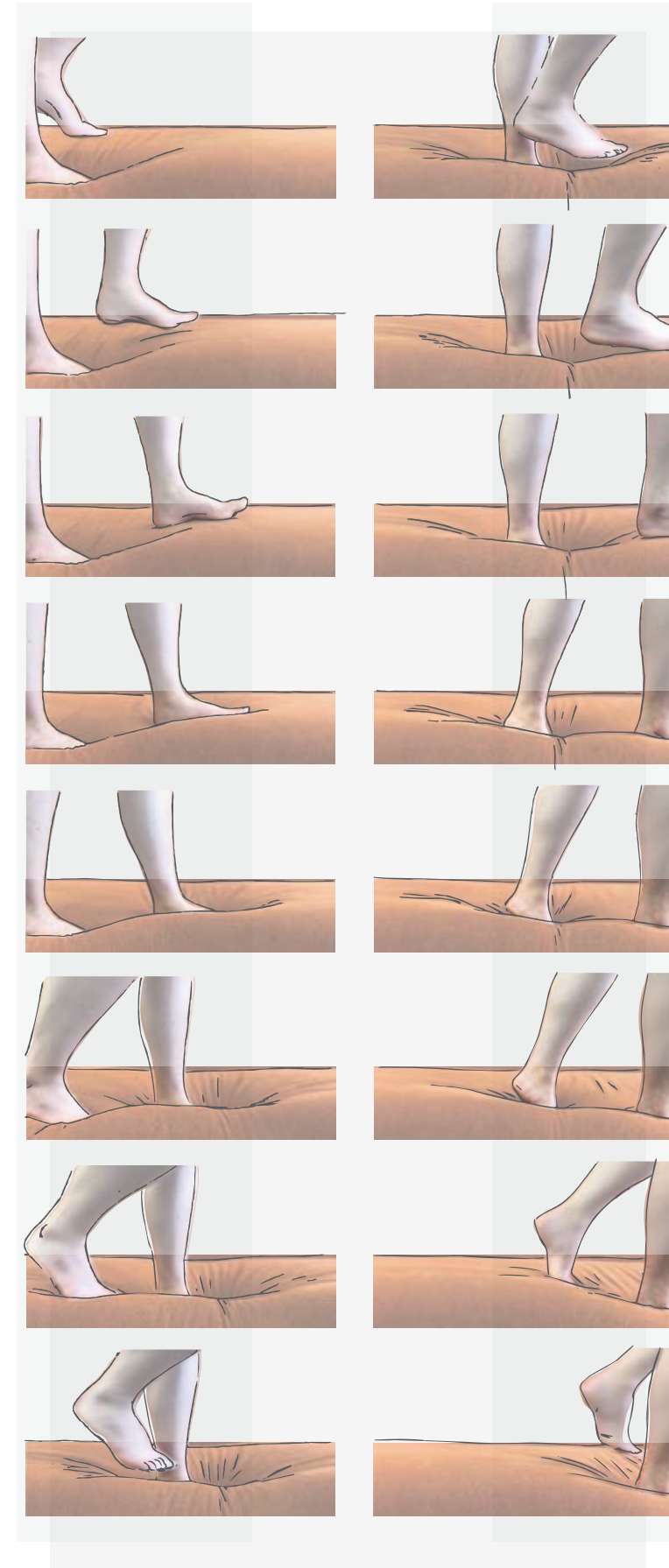


#### Walk on Leather Couch

There was a significant change to the surface, with the foot sinking quite far into the couch. The surface condensed and buckled under the foot forming thick creases. Physical contact was established on the entirety of the base and sides of the foot.

The leather felt cool, smooth, and squishy underfoot. There was a slight squeaky/peeling type noise as the leather creased and as the contact between foot and couch was broken. The bare skin almost seemed to stick to the couch slightly. It was difficult to walk over as balance was lessened by the distortion of the surface underfoot.

Figure.69



#### Walk on Velvet Couch

There was a significant change to the surface, with the foot sinking quite far into the couch. The surface condensed and molded around the foot, folding/creasing deeply and easily. Physical contact was established on the entirety of the base and sides of the foot, as well as a small amount of the top of the foot. This was due to the couch folding in on itself, enclosing and beginning to envelop the foot.

The fabric felt warm, soft, and plushy underfoot. There was no noise made when the foot came into contact with the couch. It was difficult to walk over as balance was lessened by the distortion of the surface underfoot.

Figure.70



# Sight

Sight is achieved when light is reflected off an object and through the pupil. It is then projected onto the retina at the back of the eye. The retina has millions of light sensitive cells called photoreceptors which perceive colour and brightness then convert this into a stimulus that the brain can read, creating an image. Vision is often the most dominant of the senses, being relied upon so much that it is argued that the other senses are regularly neglected during the design process and that western architecture is designed and refined to be pleasing to the eye rather than for the whole body. Pallasmaa argues, however, that favouring vision does not automatically disregard touch, hearing, smell, and taste, but rather reinforces these senses. He states that there are unconscious tactile elements to vision that can stimulate and invite tactile and muscular sensations. (Reghukumar; Pallasmaa 26–29; Celani et al. 161)

Often this visual sense is in the forefront of what people think of when designing and has been for centuries. This results in the other means of sensing objects often being regarded as less important in how people formulate an understanding of objects and buildings around them. Vision

was often regarded as the most noble and universal sense. In the late nineteenth century the automatic response to aesthetic issues of three-dimensional forms was to treat them as if they were purely visual problems. This isolation of vision as the 'key sense' and separating it from other senses, is very restricting. It reduces the sensory world into just one element, meaning that a space will not necessarily be experienced with the desired effect, as it has not been designed for or sufficiently considered. (Bloomer 28–29; Simon and Touns; Pallasmaa 19, 37–39, 56).

The eye sees the world because of light. Without light there is little to no sight. When light encounters an obstacle, however, shadow is created which can have a profound effect on the environment. Without shadow and darkness, light is not felt. They are inseparable and rely on one another to exist. This means that the relationship between architecture and shadow should be just as important as the relationship between architecture and light – both are crucial in creating atmosphere. Light and shadow can have an effect on both the conscious and subconscious perception of space,

affecting one's impression of the mood or feeling within the space. Shadow has the ability to change the entire atmosphere of a space, casting patterns over not only the walls and floor, but all the objects and bodies within a space as well. Through this, it can be used to obscure or provide clarity. Thresholds can be created, and perceptions of space altered, through placement of bright and dim zones in relation to each other, forming different moods. Wolter claims that comforting and calming atmospheres can be created through the use of darkness and shadow. There are also thermal elements from light and shadow – the ability to make a space feel warmer or cooler is tactile in nature, despite being primarily thought of as relating solely to vision. Materiality is linked strongly with all of these elements, with treatment and finish having a powerful effect on the reflection, absorption, and diffusion of light within a space, changing the atmosphere massively with each different light quality. (Franck and Lepori 74-76; Reghukumar; Pallasmaa 49; Wolter 3-4, 16, 19, 25, 39, 158-159).

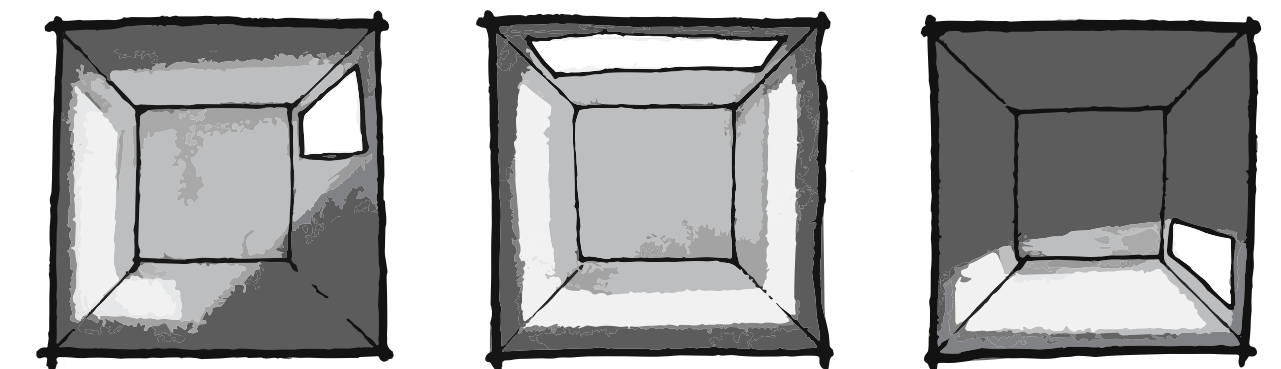


Figure.71: Author's own drawing depicting how different lighting and shadow can change the atmosphere of a room



# Therme Vals

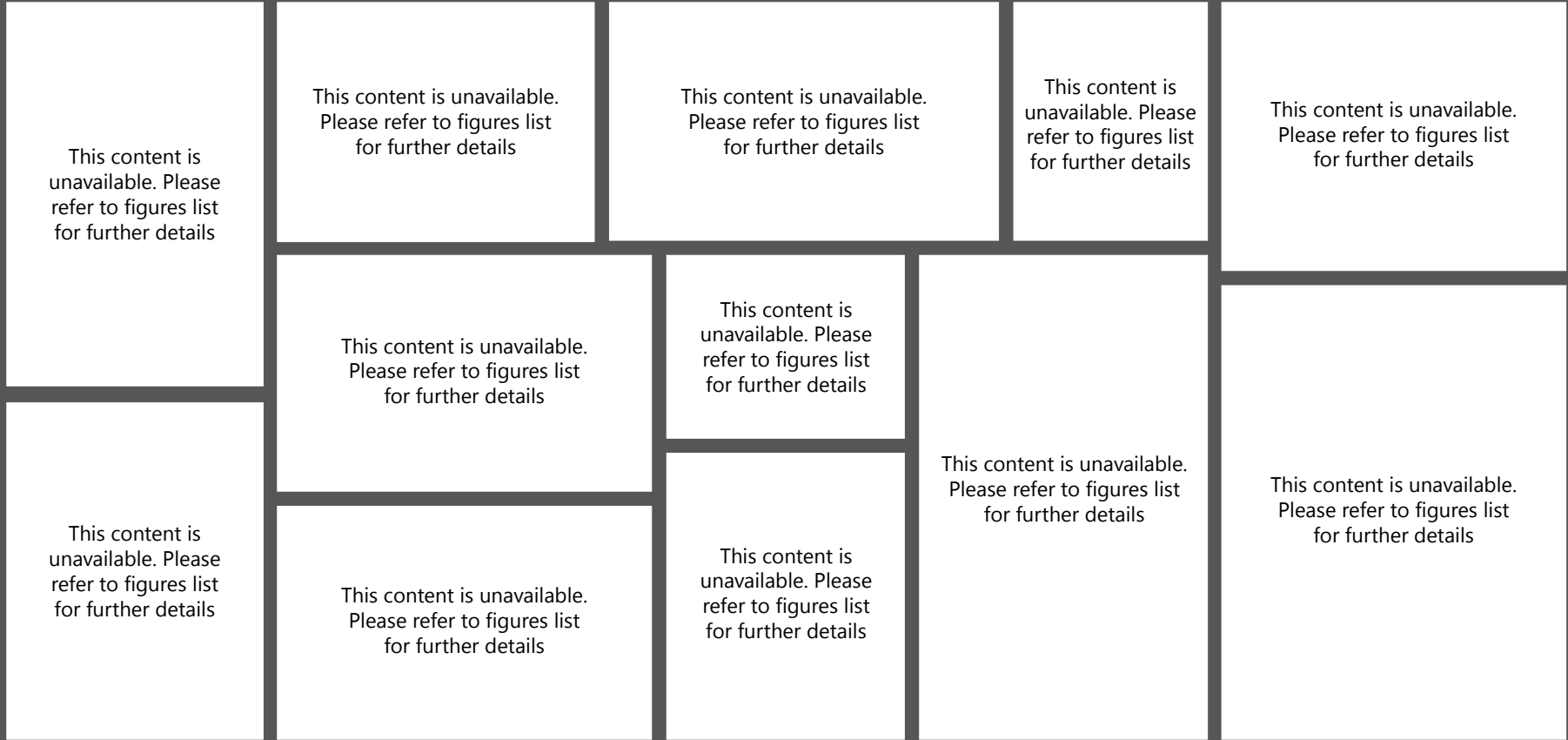
Peter Zumthor, Vals, Switzerland, 1996

Therme Vals, by the architect Peter Zumthor, is a spa and thermal baths, in Vals, Switzerland. The series of chambers and bath pools is an intricately designed sensory experience, built using a strict material palette that heroes the locally quarried Valser quartzite slabs, creating a cavernous labyrinth of sensual pleasures. It consists almost entirely of concrete, stone, bronze detailing, and of course water. This is broken only by the changing rooms, which are panelled in polished red mahogany. Every detail has been considered, with even the sipping cups being made of bronze.

Almost invisible from above, partially due to the grass that grows over the roof, the building appears as an embankment or earthwork from the road below, and is accessed largely through a curving under ground tunnel, which works to dislocate the individual from the outside world. The complex is comprised of 15 different units, each with a cantilevered concrete roof that fit together like a puzzle, with an 80mm gap between each roof piece. These gaps covered by glass allow a stream of natural light into the pools below, and seem to make the heavy concrete rooves appear to float.

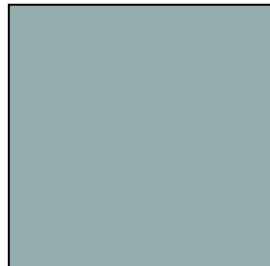
Pools vary in temperature and depth, but for the most part are secluded and closed off from one another with right angles that surround the bathers in stone. The senses are considered quite carefully in all elements of the bath house, with different temperatures eliciting different sensory responses. The hottest and darkest pools,

respectively, play with sound, having a perimeter trough around the pool for waves to drop into noisily, or a loop of music composed from playing with stones. Another pool is in a high chamber and lit from below. The direction of lighting has quite an effect on the appearance of the stone. With overhead illumination the stones above the water level seem pale and desiccated, while the stones below water level are left with quite a dark and viscous appearance. This is reversed in the pools that are lit from below. A few of the chambers, however, are so dimly lit that the walls can barely be seen at all. (‘Therme Vals | Architekturbüro Peter Zumthor’; ‘The Therme Vals / Peter Zumthor’; Ryan)

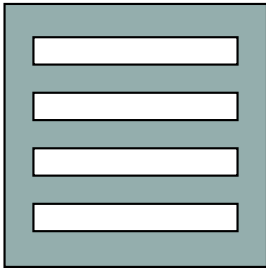


Figures.72-83: Interior and Exterior of Therme Vals

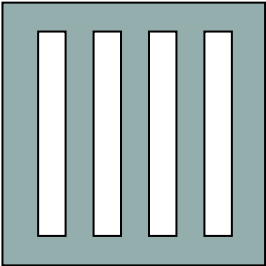
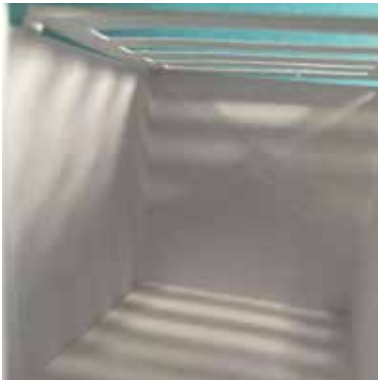
The effects of shadows in space were tested by starting with a 50mmx50mm cube and natural lighting. From here, holes were cut into the top surface using a variety of patterns inspired by findings from earlier research. The resulting shadows were documented and the effects noted.



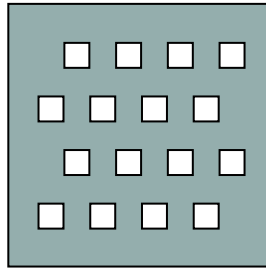
- Dark
- All shadow
- No light
- Small



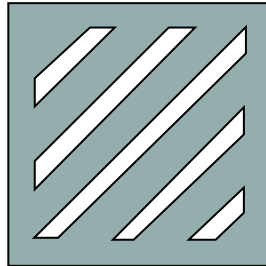
- Lots of light
- Back wall appears closer making space feel short
- Shadows change as light moves



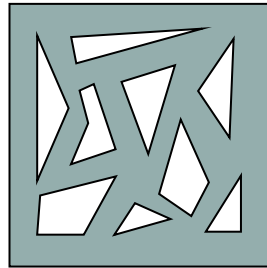
- Lots of light
- Back wall seems further away
- Shadows change as light moves



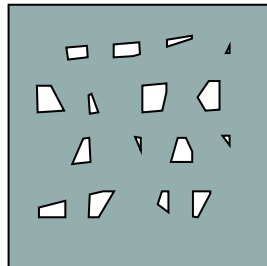
- Many patterns depending on light source
- Some light but not lots
- Space seems taller



- Lots of light
- Shadows change as light moves
- Shape of space is slightly distorted



- Lots of light
- Irregular shadows
- Patterns change depending on angle of light
- Space seems bigger
- Tree canopy



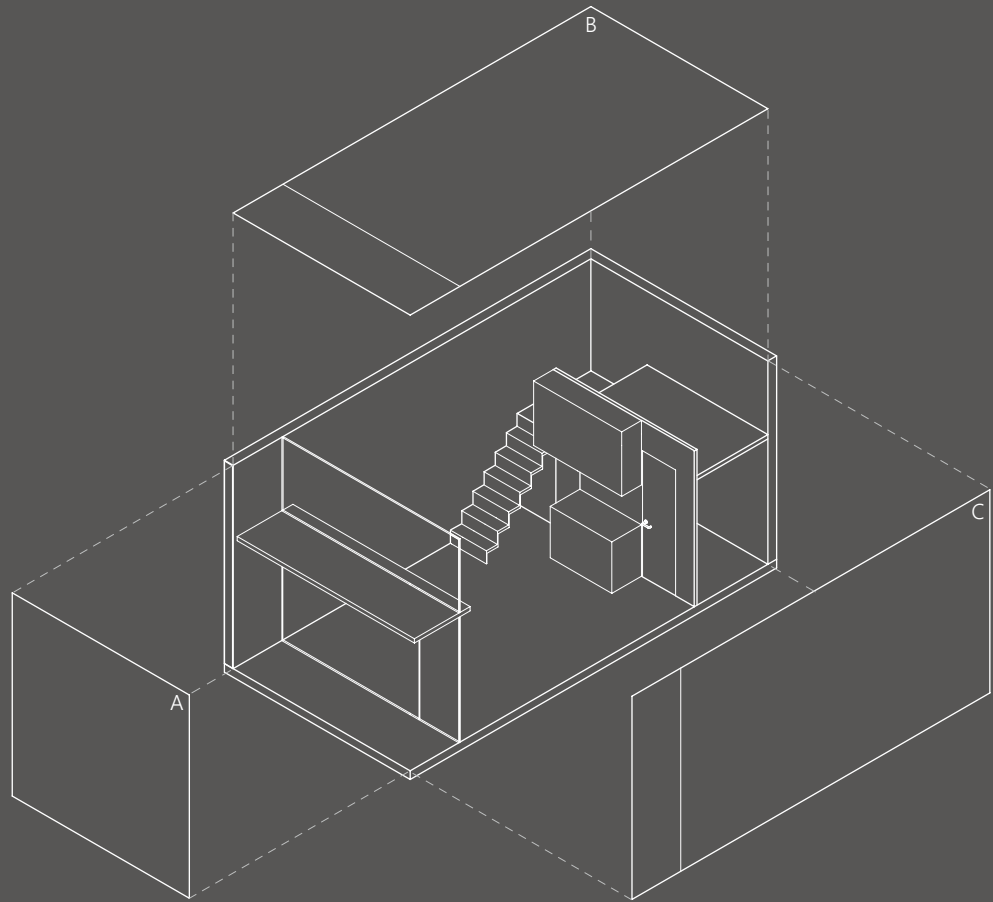
- Dark
- Interesting/irregular shadows
- Shadows change as light source moves
- Tree canopy



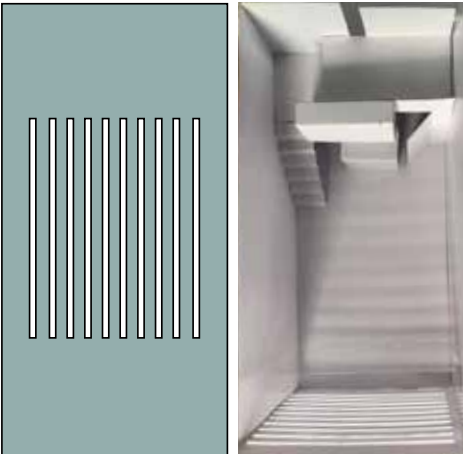
A series of experiments was conducted within a scale model of a KODA housing unit to see how shadows and lighting would effect a space on a slightly larger scale. The results from cube shadow experiment informed the shapes that were used to create shadow within the KODA model seen to the right.

The first three sets from this experiment look at how the space would change with lighting coming from different surfaces within the KODA model, with the second two also incorporating colour.

The fourth and final set from this experiment looks solely at colour and how it can divide a space.

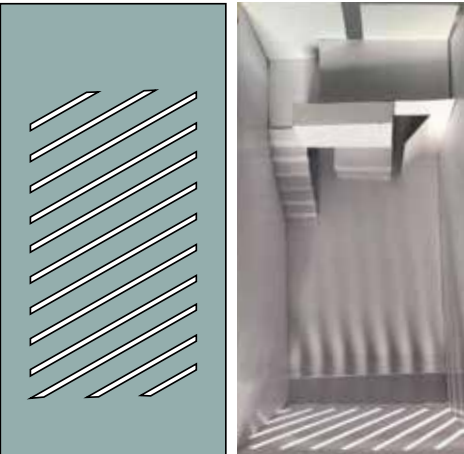


Horizontal Lines



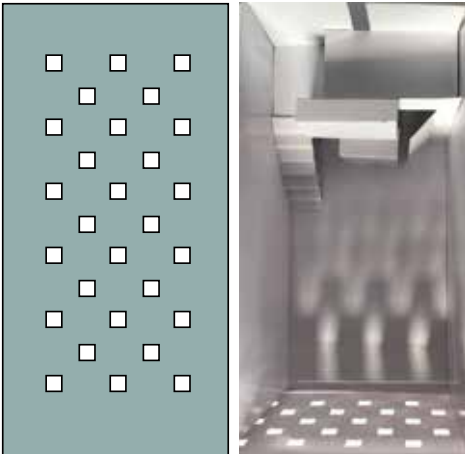
- Provide reasonably even spread of light throughout space.
- Space appears slightly long but wider. This contradicts findings from previous research.

Diagonal Lines



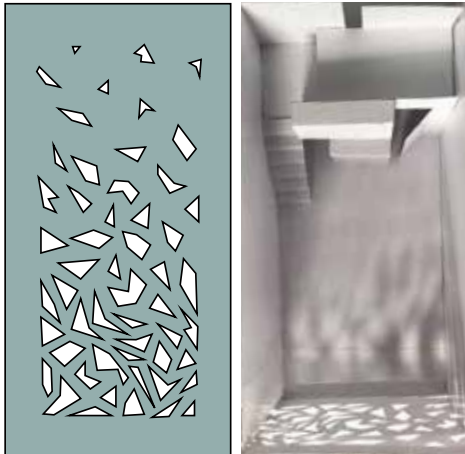
- Shadows appear as almost vertical lines.
- Space appears long and narrow.
- Uneven dispersion of light in the front of the space but evens out towards the back.

Small Squares



- Uneven dispersion of light
- Space appears short and wide
- Shadows 'bleed' into each other further back through the space

Random Geometric Shapes



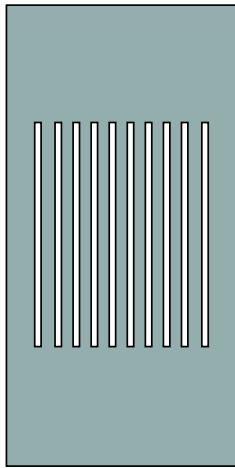
- Uneven dispersion of light
- Interesting shadows, more shadow towards front of space
- Shape of space more difficult to distinguish

Overall findings from cut outs on front;

- Shadows distort
- Shadows bleed and disperse unevenly.
- Findings would likely be altered if the ceiling was entered for this set of images however the method of documentation would also need to be altered.

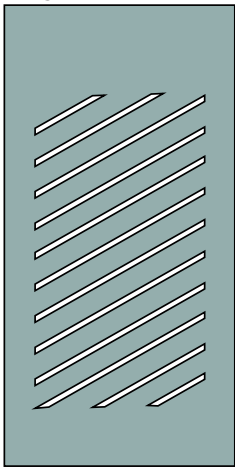
B. Cutting holes into the longer side wall

Horizontal Lines



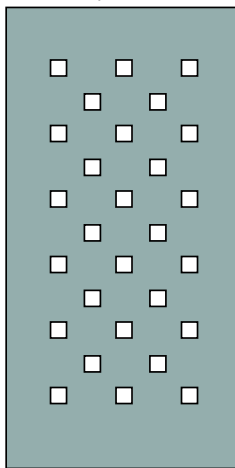
- Draws eye towards back of space
- Space appears shorter

Diagonal Lines



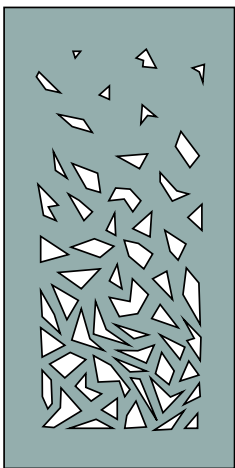
- Space appears longer
- Lines distort at different angles on each surface disguising shape of space

Small Squares



- Allows less light in than other patterns
- Space appears wider

Random Geometric Shapes



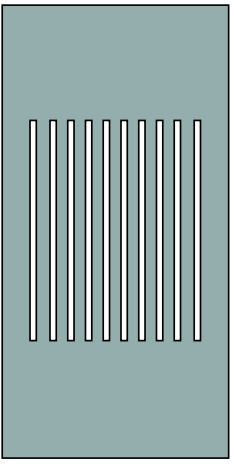
- No regularity to shadows.
- Shape/size of space disguised
- Space appears longer

Overall findings from cut outs on side;

- Shadows distort
- Shadows are not crisp - bleed slightly

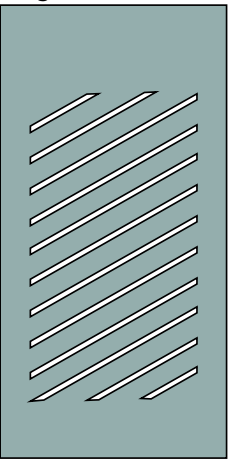
C. Cutting holes into the ceiling

Horizontal Lines



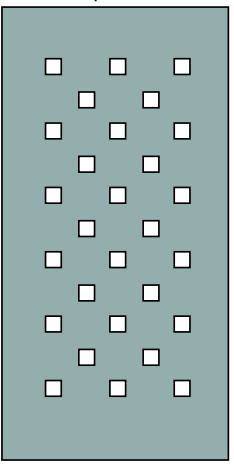
- Draw eye through space
- Lots of light, evenly dispersed

Diagonal Lines



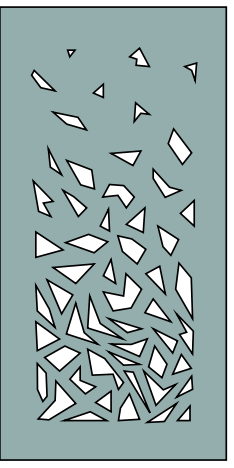
- Shadows draw eye up. Flipping angle direction could change this.

Small Squares



- Light evenly dispersed.
- 

Random Geometric Shapes



- Strong contrast between light & shadow on wall.

Overall findings from cut outs on ceiling;

- Shadows are crisp and high on the wall. This would likely change as the angle of light changes.
- When translucent material (in this case tracing paper) is placed over openings there are no shadows created although the light still illuminates the pattern in the ceiling.



B. Cutting holes into the longer side wall



Colour came out a lot stronger when on ceiling compared to on wall. Purple makes the space feel darker and cooler. Pink and red seem angry, warm, and sensual. Yellow and blue make the space feel light. Yellow is warm, blue is cool and calming. Green is light and refreshing.

C. Cutting holes into the ceiling



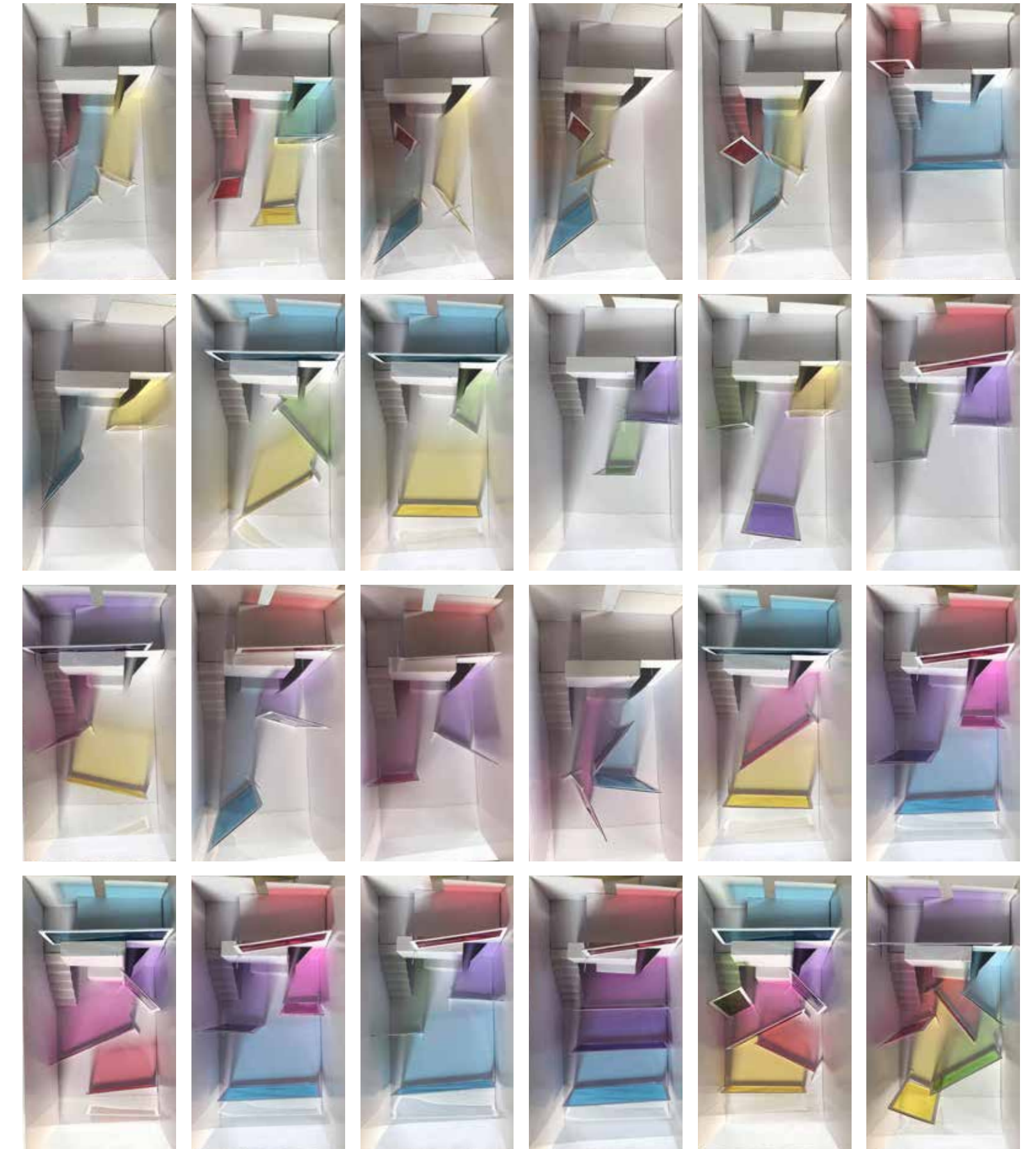
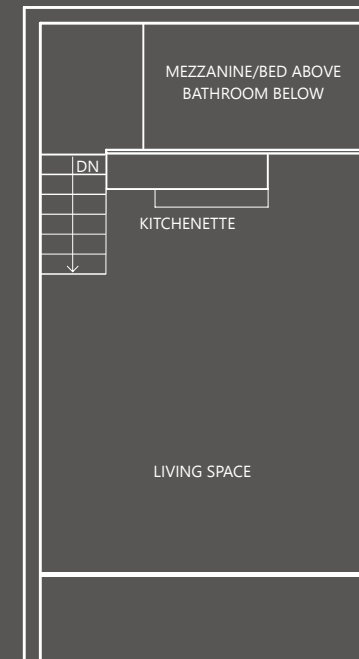


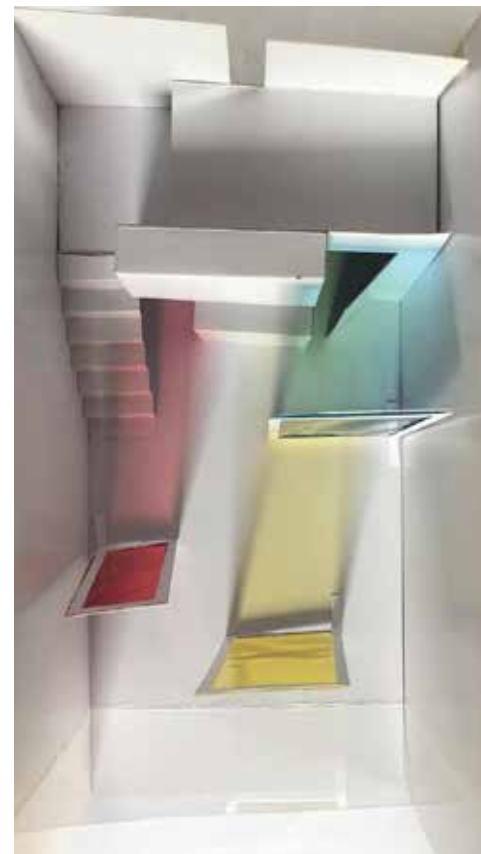
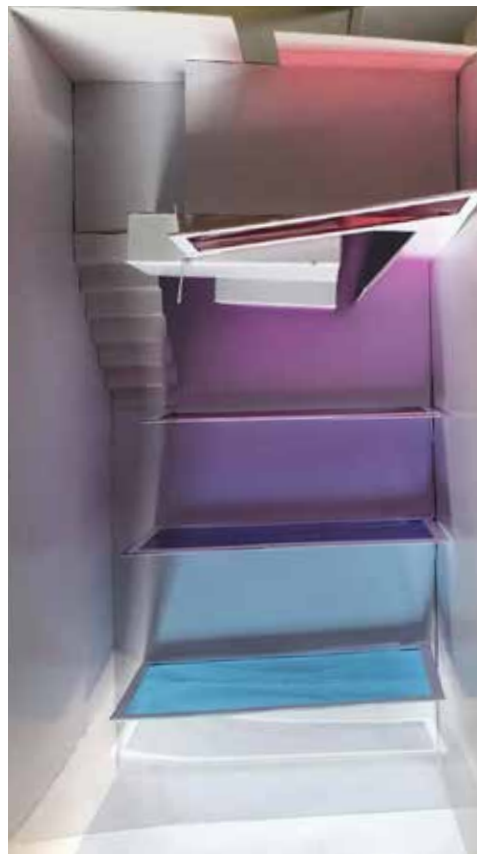
These specific images were chosen because of the saturation of the colour within the space, and because they display how colour and shadow patterns can have a strong effect on the atmosphere within an identical space.



This set of images records the findings from an experimentation of colour in space. Partitions of varying sizes and colours were placed strategically into the model of KODA in ways that would alter and separate different spaces. This played significantly upon the idea of the intimacy gradient.

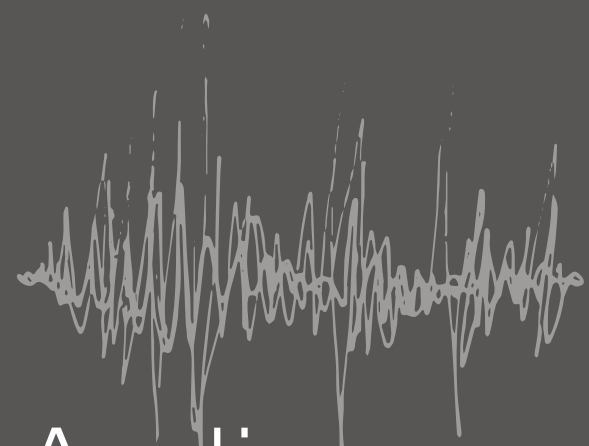
The layering and blending of colours meant that many different atmospheres were created within one space. The colours were able to create a distinct separation between spaces and highlighted different areas of interest, taking the focus away from some areas whilst emphasising others. There are also different moods created through the different colours which means each space can have a different effect on the emotions and reactions of the occupant.





These specific images were chosen because they display a blending of colours into other colours, and different zones of colour - warmer to cooler colours and vice versa as spaces move from public to private.





# Audio

Sound is heard through compressions and refractions of air caused by the movement of air particles. These compressions and refractions cause pressure changes which in turn cause the thin tympanic membrane within the ear to pulsate. Three tiny bones called ossicles connect this membrane to the inner ear. Vibrations within the inner ear are turned into an electrical impulse by the hair cells which stimulates nerve conduction to the brain. Loudness and pitch are the two main qualities of sound that we can identify. Hearing can help people to orientate themselves within a space as it is omni-directional, so the direction from which the sound came can lead people in the right direction. This is heavily relied upon by people with visual impairments so the quality of acoustics within a space can have a significant effect on the accessibility and appeal of the space. Sound within a building is the result of the combination of many elements such as volume, form, and materials used. Acoustic qualities should relate the size of a room to the occupant in order to avoid confusion. Larger rooms sounding larger and smaller rooms sounding smaller reduces potential danger. Complexity of rooms such as double height spaces can create confusion and discomfort for

visually impaired users. This can be altered and improved by providing differences in material, forms, and volumes that create different pitches of sounds and reverberation times. (Solon 25-26; Reghukumar; Rhyl 114-116).



# Smell & Taste

The nose makes the eyes remember - Pallasmaa

Smell and Taste are linked very closely with each other, with most forms of taste being differentiated and amplified by smell. This is in part due to the physical connection between the mouth and nasal cavity. Approximately four to eight different types of taste can be distinguished by the human tongue within the categories of sweet, salty, sour, and bitter; but the human nose can detect more than 10,000 different odours, needing only 8 molecules of substance to trigger an impulse of smell. Every dwelling and person has a particular smell. This smell can unknowingly trigger emotions and memories, bringing one back to a space that may have been entirely forgotten by retinal memory. Odour can make a space identifiable, as well as help to orientate people, capturing and preserving the memory of a space through the smell itself, along with its density and intensity. The smell of a space is affected by many things, including materials and their finishes. Wood, for example, has a very recognisable odour which can be altered significantly by the type of varnish, wax, or polish used. (Reghukumar, Pallasmaa 54, Solon 27-28).

Key Findings from Chapter 3

- Most features of the environment can be detected by at least two senses.
- Based on what an individual sees, hears, touches, smells, and tastes, an experience will be evaluated as to whether it was enjoyable or not. Often a person’s mood at the time will alter their experience.
- Emotional responses are triggered by environmental stimuli. Someone who experiences a space through all of the senses will often connect more with a space than someone who experiences that same space through only one sense.
- Materiality, shape, and finish can yield certain emotive responses. Surfaces can simulate interpersonal touch triggering positive emotions.
- Skin is the primary sensory surface through which the world is perceived physically, so situations where bare skin is touched are often more intimate and primal, eliciting a stronger emotive response. Certain areas of the body are more sensitive than others.
- The sense of touch/haptic channel can be used to communicate emotion. It can communicate whether the emotion is positive or negative, and increase the intensity of the emotion. Several emotions can be communicated through touch alone. These include sympathy, love, gratitude, happiness, fear, anger, sadness, and disgust. Specific patterns and physical features such as intensity or force of the tactile patterns; location and duration of the touch; and the velocity across the skin are key in communicating specific emotions. Lower intensity/force and slower velocity of movements are more pleasant. Soft/smooth surfaces are more pleasant than coarse/abrasive/stiff surfaces
- Touch has the ability to alter the environment through the process of perceiving it. It interacts most directly with the physical world.
- Materiality is linked strongly with all the senses. Treatment and finish have different tactile elements, as well as altering the reflection, absorption and diffusion of light

- within a space. This can massively alter the atmosphere of a space. Many qualities can be produced through a select number of materials when they are treated/processed differently.
- Once colour/shadow is removed, patterns arise from different textures. These patterns can be utilised in later models and iterations.
  - Changes in texture or material are often used as signals for special events or changes in the way one should act within space. Contextual clues of the intended purpose of the space help with this signaling. Variation and complexity of textures & materials, changing temperatures, contrasting volumes can all be utilised to create and define a space.
  - Vision has unconscious tactile elements that can stimulate and invite tactile and muscular sensations.
  - Light and shadow rely on each other to exist and to be felt. They are inseparable. This means the relationship between architecture, light, and shadow is crucial to creating atmosphere. Light and shadow can also be used together to create threshold, and to alter perception of space. Shadows and dim zones can create comforting and calm atmospheres.
  - The way a space is represented can have an effect on the design. Emotive methods of representation such as physical models and rendered perspectives are more likely to allow a space to be designed according to the desired atmosphere and emotions that the space should evoke.
  - Architecture often overlooks the horizontal plane. The floor and ceiling are often forgotten and neglected when pushing spatial and geometrical boundaries. A dialogue between building, surface, and body is created when these norms are challenged.

To be considered for framework:

Variation and complexity of textures and materials, changing temperatures, contrasting volumes can be utilised to create and define spaces. They can also yield certain emotive responses with soft and smooth surfaces being more pleasant and yielding more positive emotions.

Connection between body and ground is crucial. Push boundaries with the horizontal plane

Shadow is crucial to light, both are key to creating atmosphere and threshold. It can accentuate and emphasise tactile elements. Shadow or dim zones can create a calm and comforting atmosphere.

# CHAPTER 4

## INITIAL DESIGN / REFINING FINDINGS

This chapter combines key findings from the research to date and refines them into usable criteria that form the basis of a framework for designing for touch. This is done primarily through a series of sets of intuitive maquettes.

Physical model making will be the core method used as it is the most tactile way of designing. As this research is focusing primarily on using touch it is relevant and important to be using the hands and touch when designing.

The models take key findings relating to designing for touch and elements of sight such as light, shadow and colour. This is because these visual tactics can emphasise and enhance the tactile elements. Some of these sets are then processed and drawn over to relate back to a scale and function.

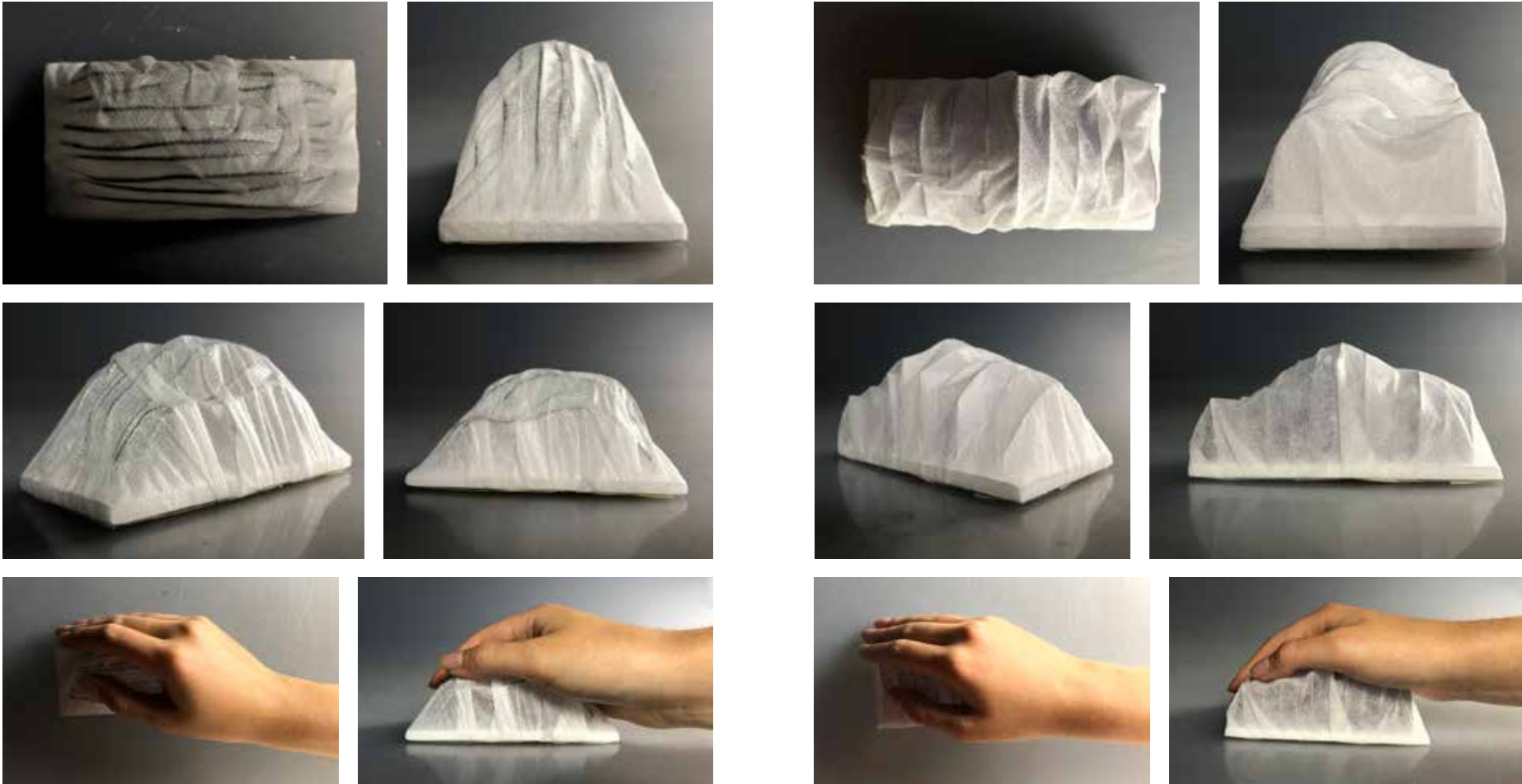
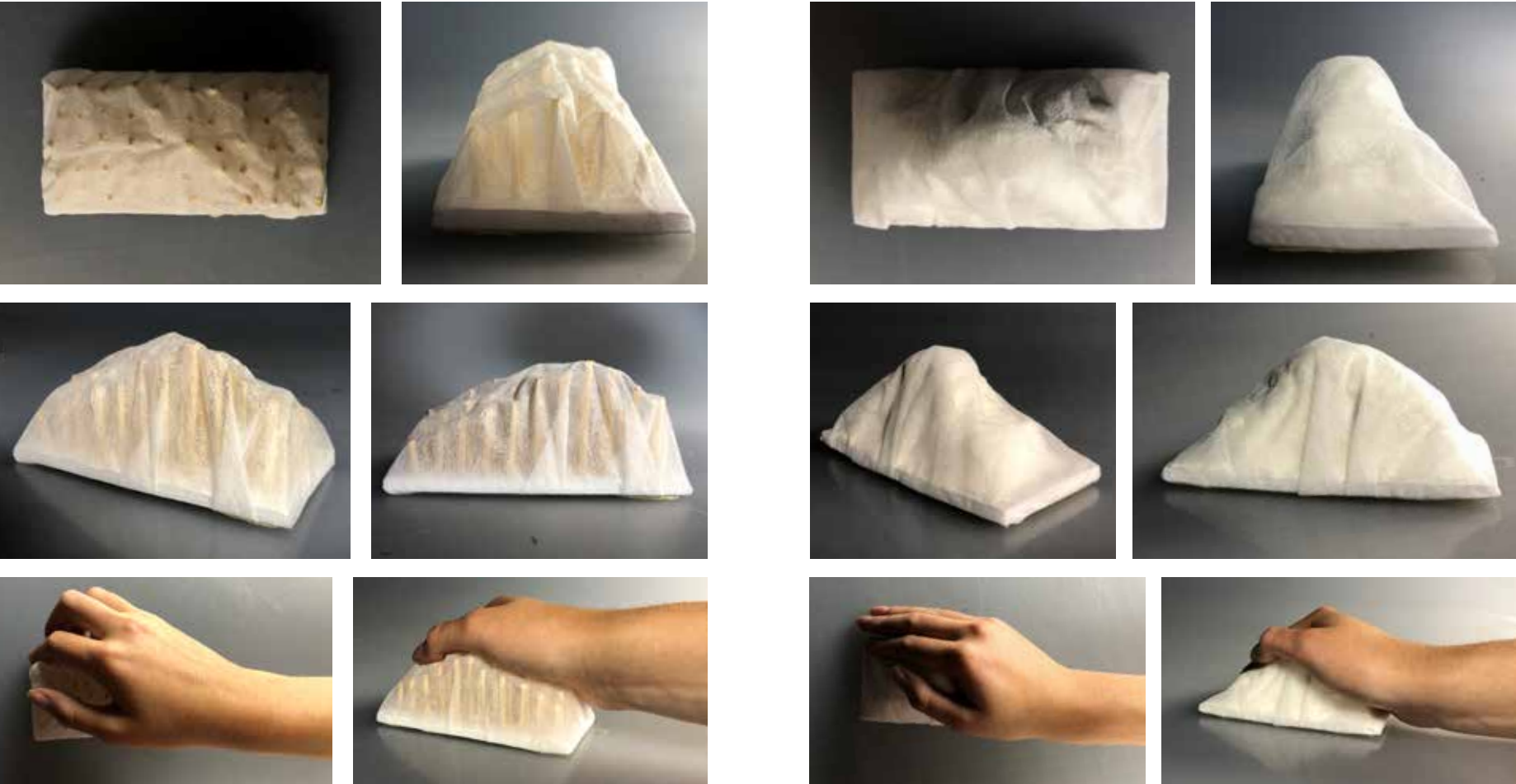
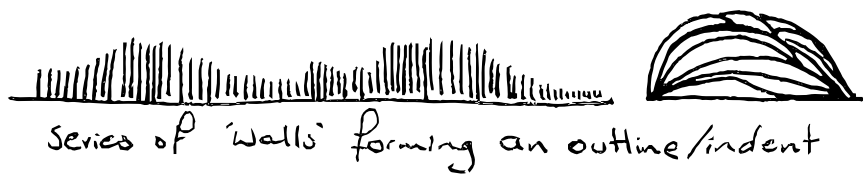
From here a series of hybrid models will be created. These models will combine elements from the initial intuitive series, and start to explore how inhabitable spaces can be created. These models will begin to form the base of the design of a small home designed for touch.



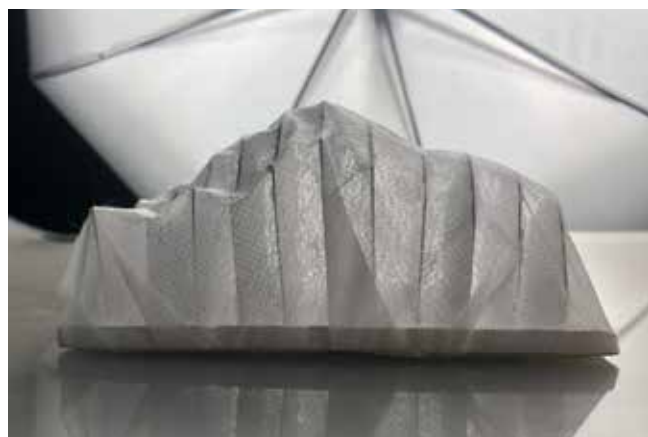
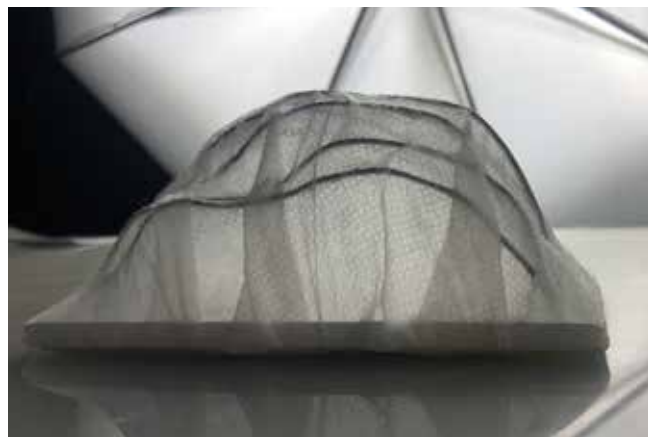
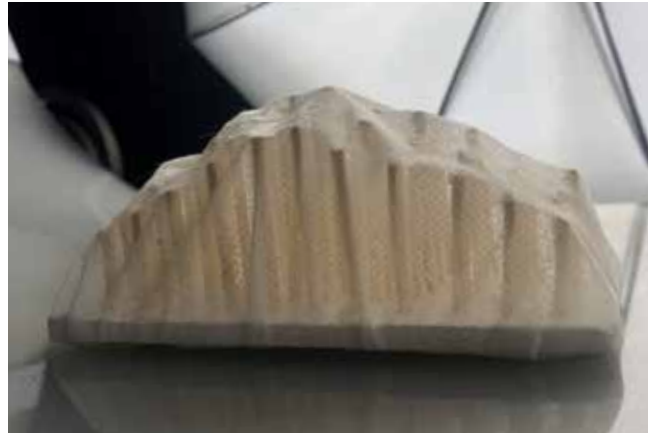
This first set explored the relationship between architecture and the interior. They looked at how the interior can influence the exterior of the building and how the interior can strongly contrast the external shell of a building.



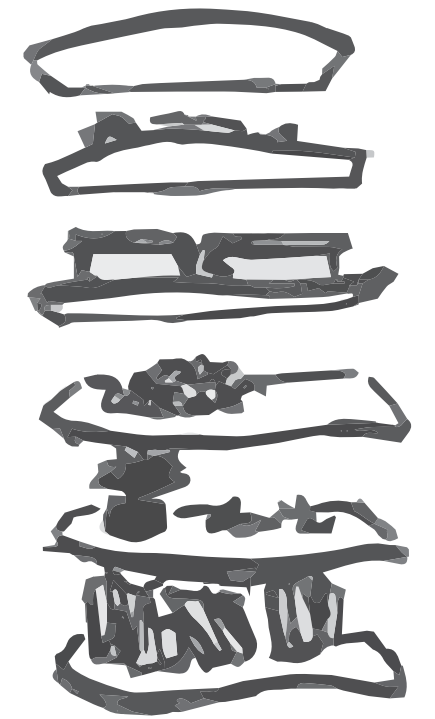
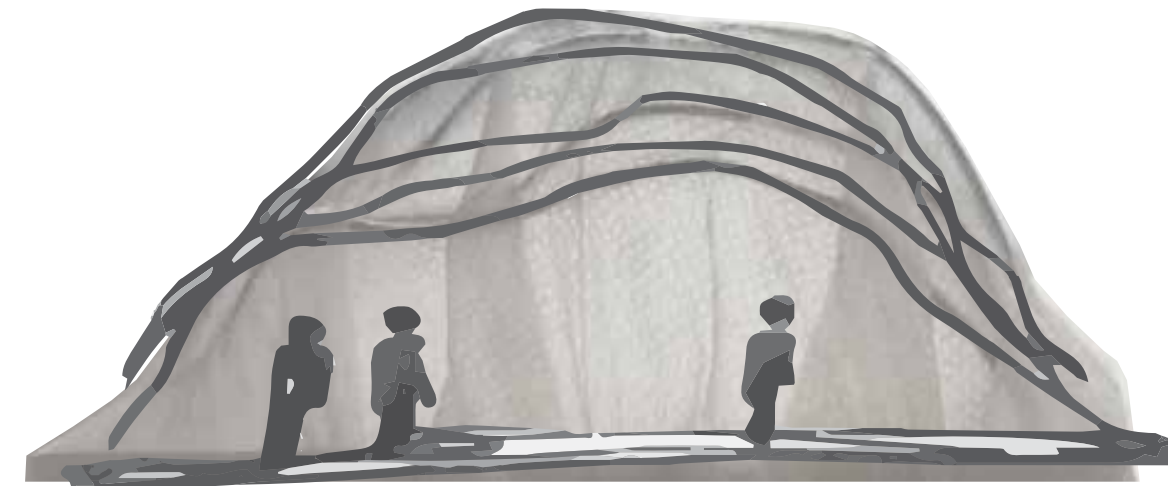
tactile structure



The second set of this series explored the tactile side of structure. The form of these was inspired by the shape the hand makes when resting on, or holding something. Four different materials were used to create a similar shaped structure for each model. Pieces of fabric were then stretched over these structures. Each of these models produced a unique tactile feel.



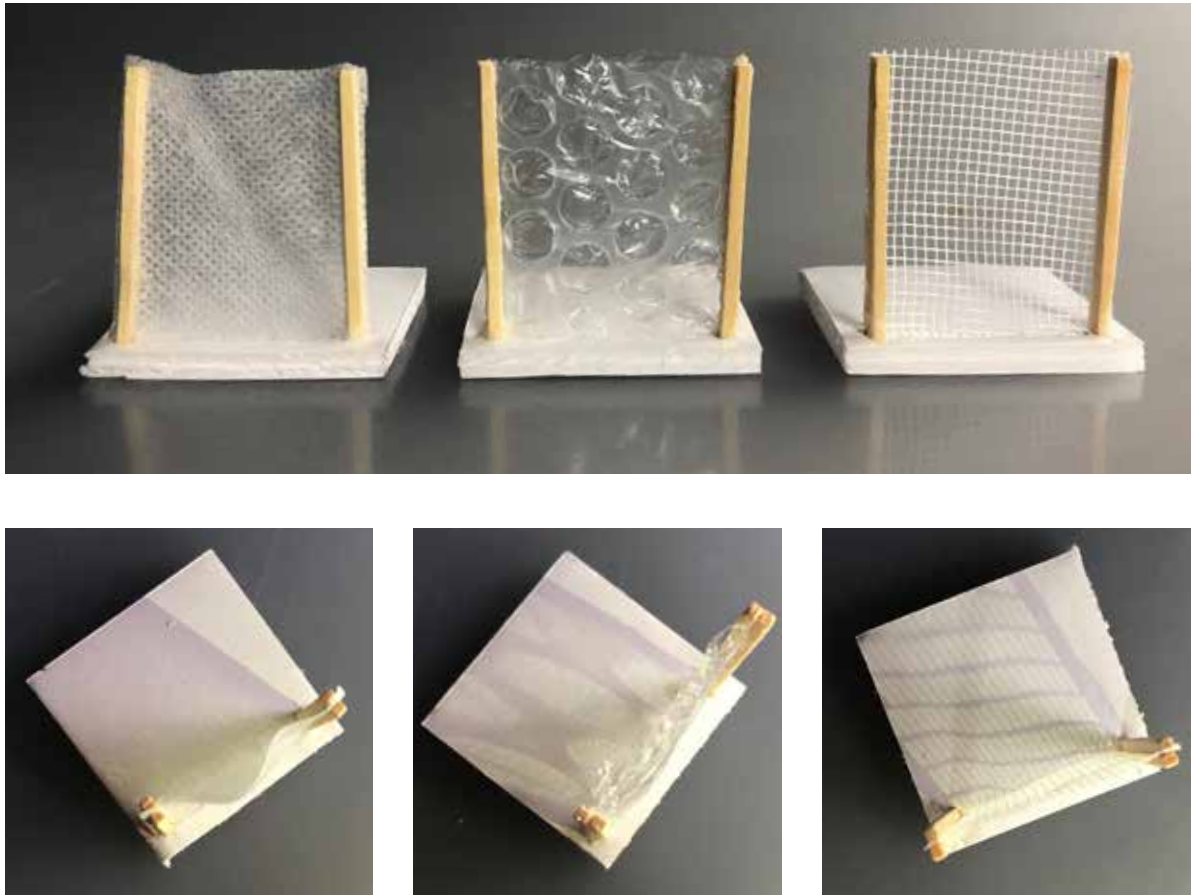
These images show the models being lit from behind. This is to illustrate how each structure provides different lighting qualities, as well as emphasising and highlighting the differences in structure.



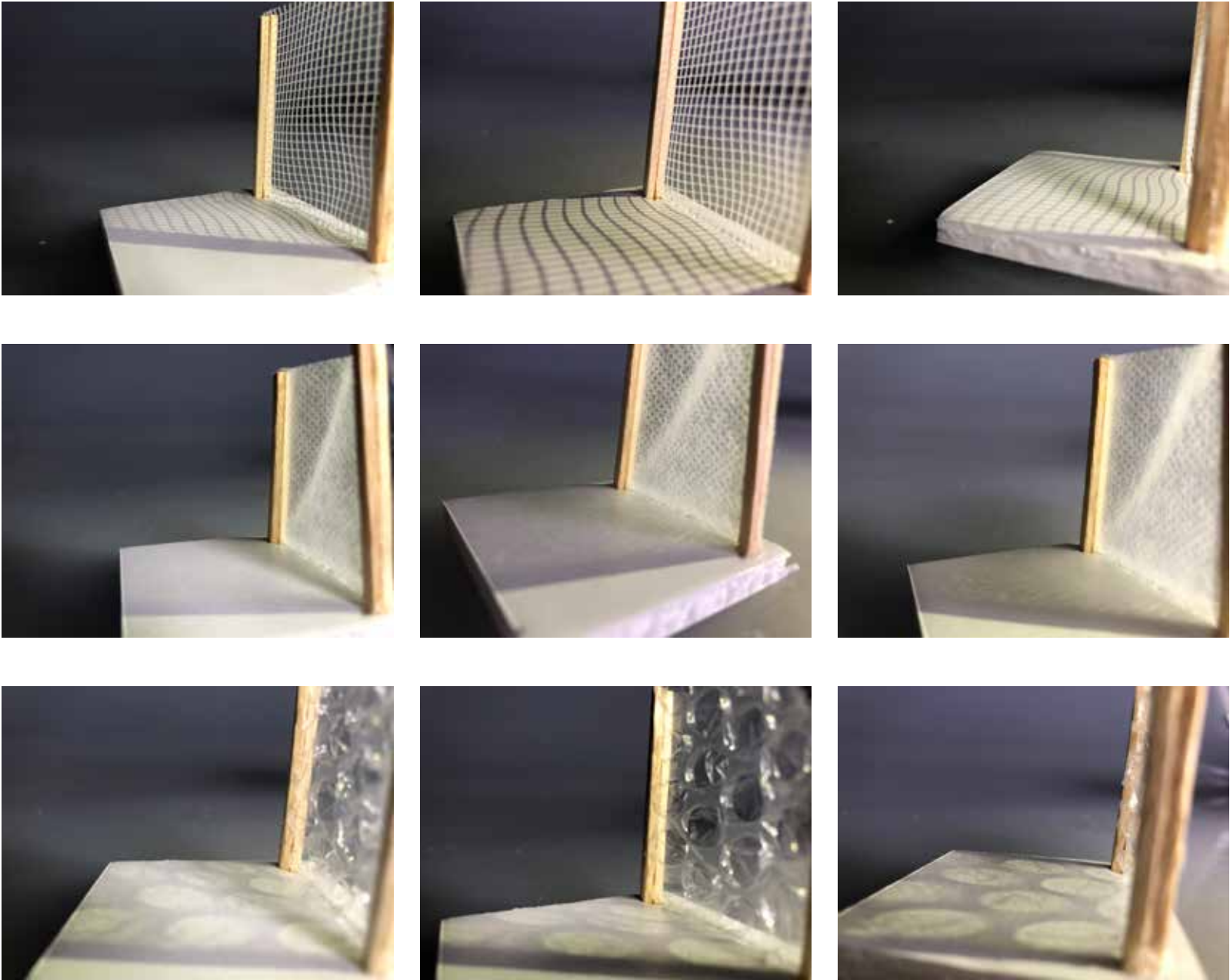
This can be applied at multiple different scales, from doorhandles to wall coverings or the structure of the building itself.



tactile shadow

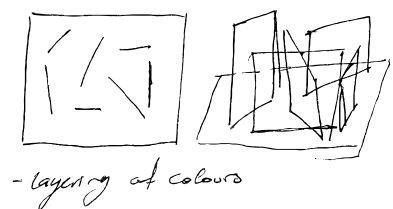


The third set of intuitive models looked at how different tactile materials can produce different shadows which can alter the atmosphere within a space. They also show different levels of privacy that can be achieved through the use of different materials, and how they do not necessarily relate to the depth of shadow created.



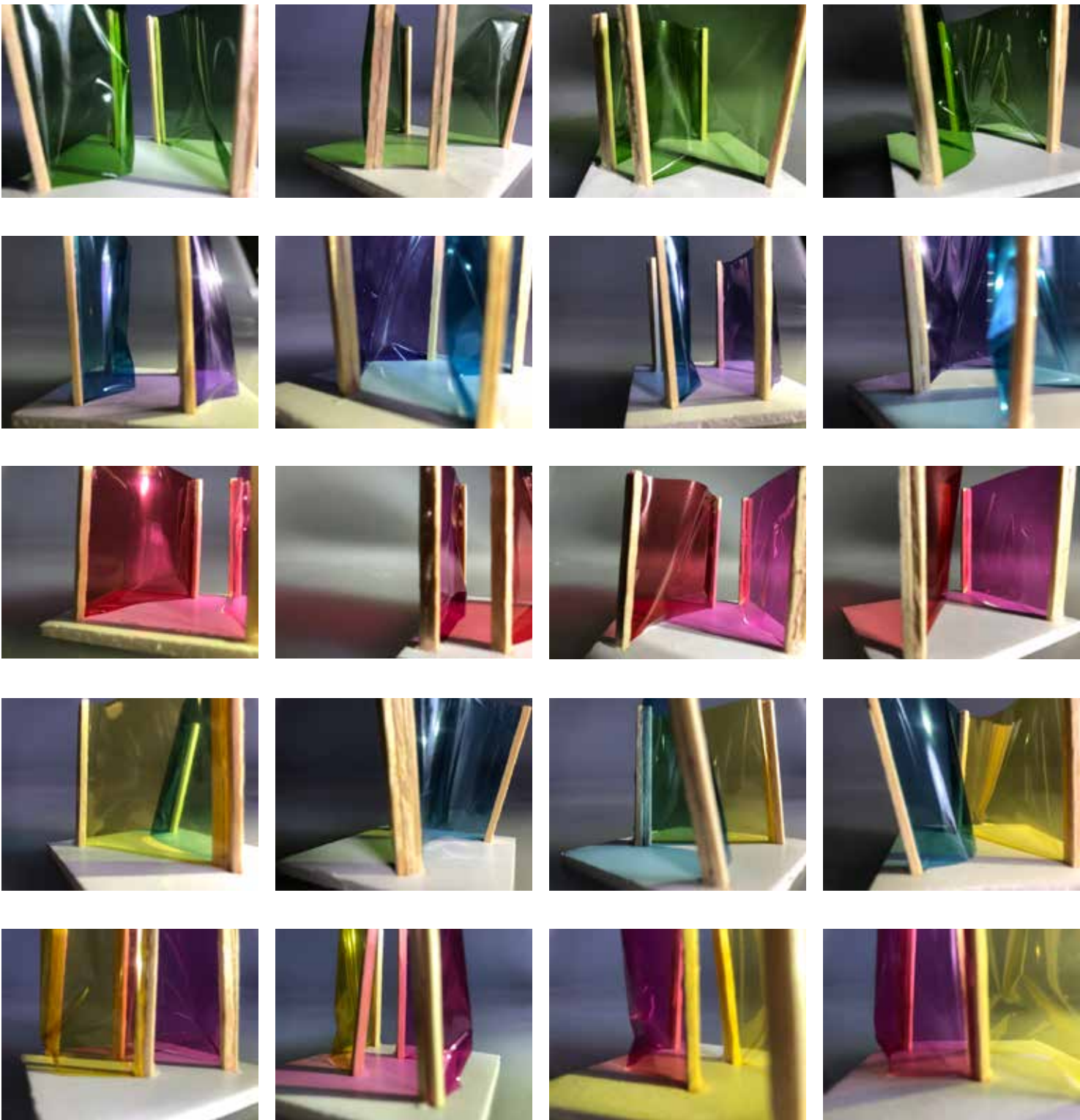


coloured boundary

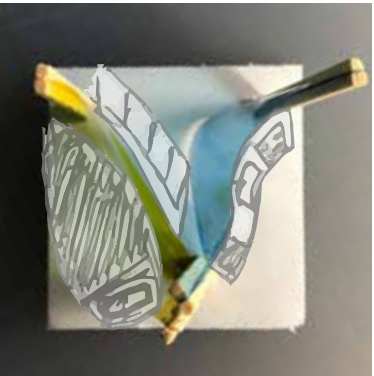
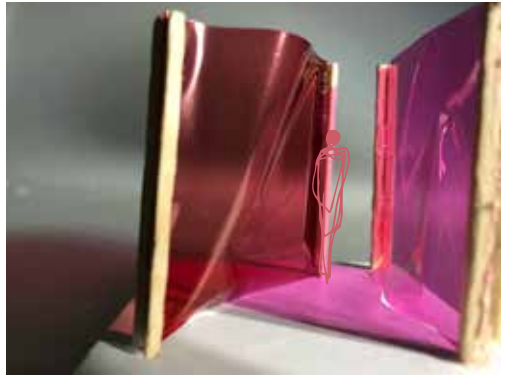
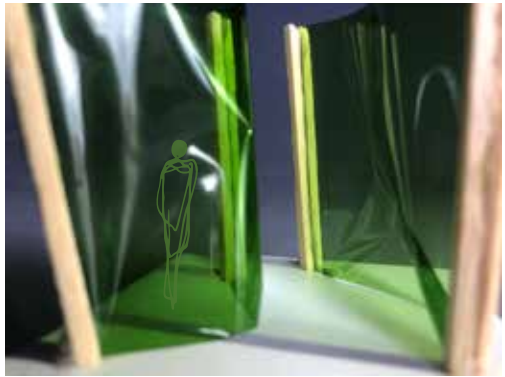


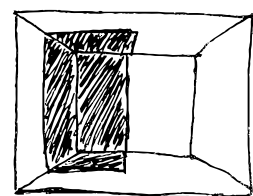
The fourth set played with how colour can define space and mood. Translucent screens cast an infinite number of shadows that vary depending on the direction and strength of the light shining through them and the tactile qualities of the space. The depth of colour can also vary due to the surrounding elements such as other coloured screens or the colour of the surface that they are cast on, blending together in different ways. Each of these qualities can be used to create boundaries between spaces and change the atmosphere within a space.

Figures.119-120









## tactile boundary



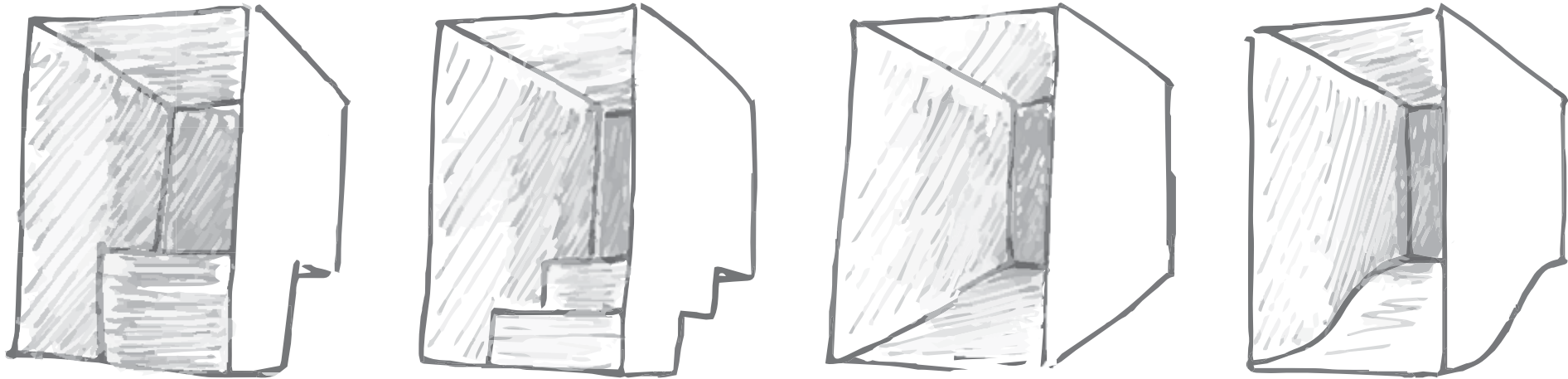
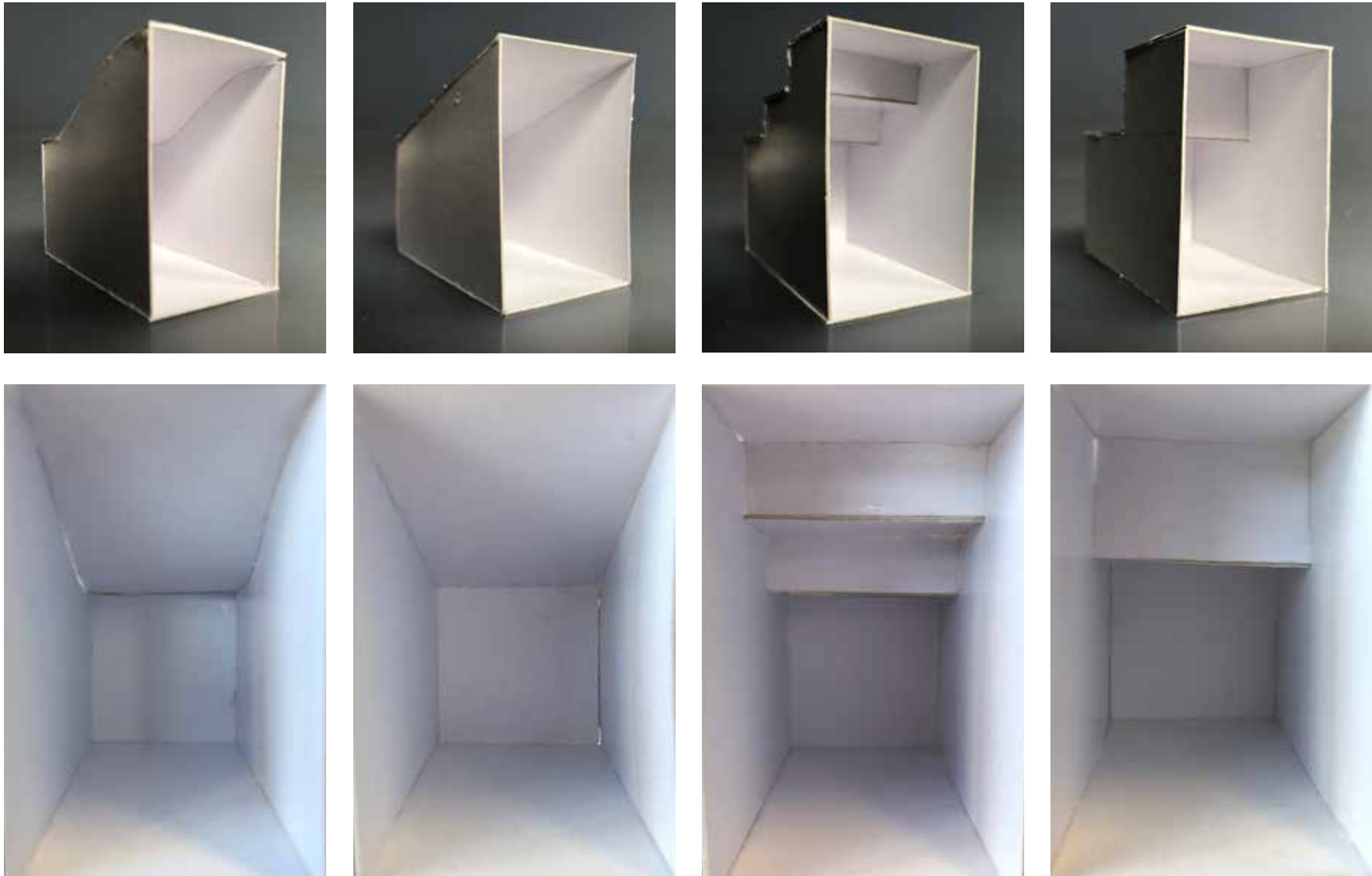
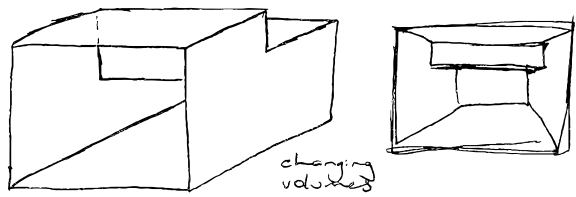
The fifth set of models explored how different tactile qualities could communicate a change between spaces or functions within a space. This was enhanced by a change in colour or volume. The tactile qualities of a surface have the power to influence the function within the space and vice versa.







volume as boundary



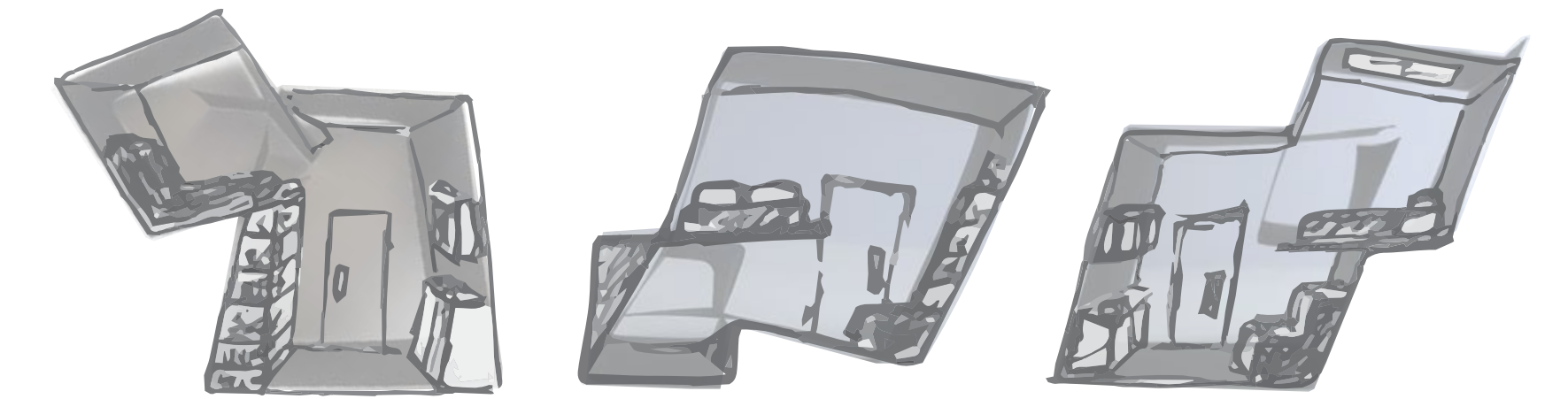
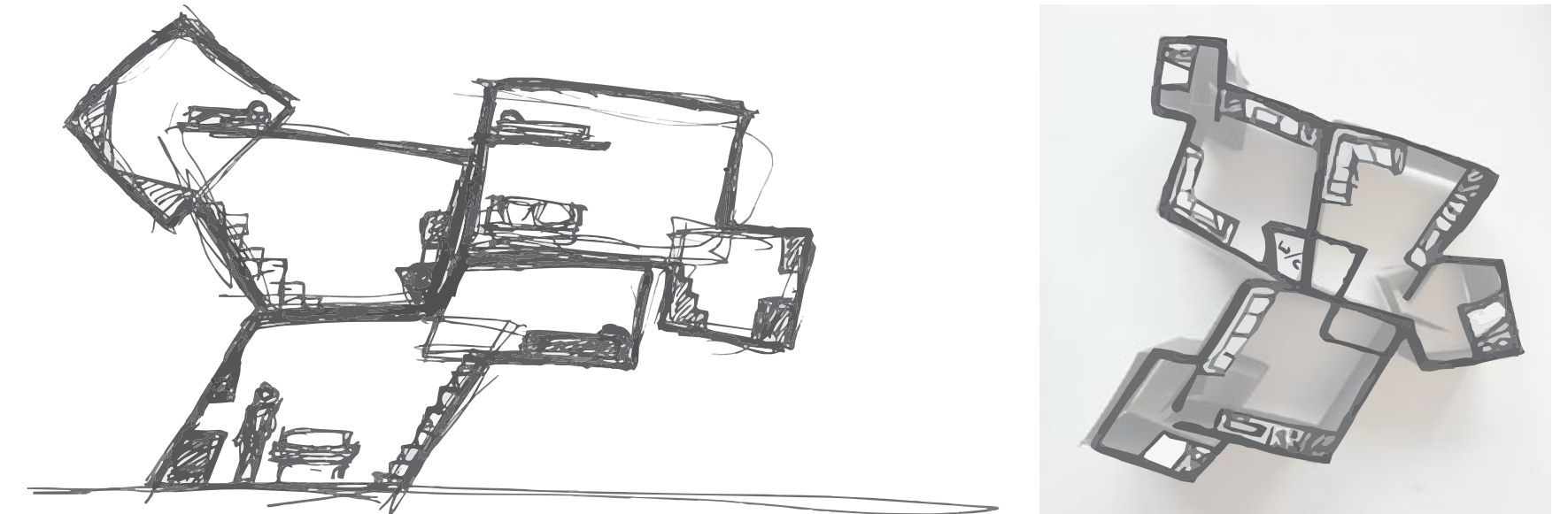
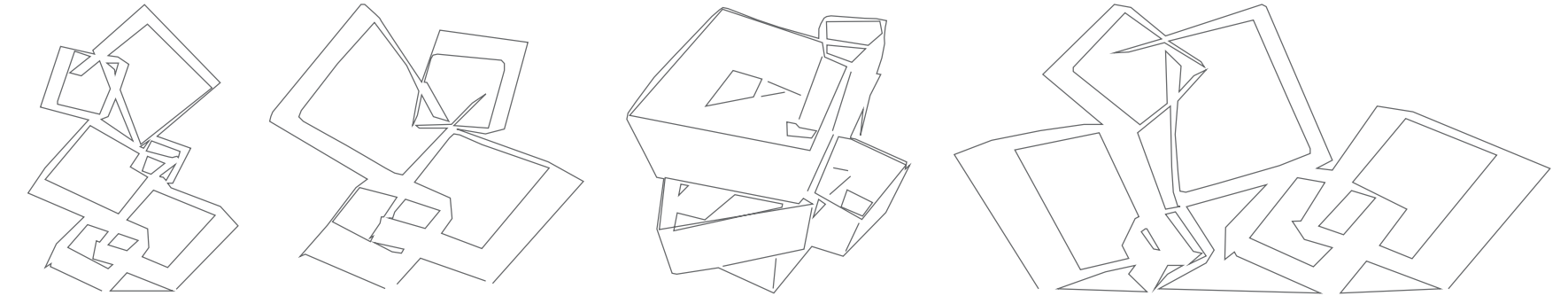
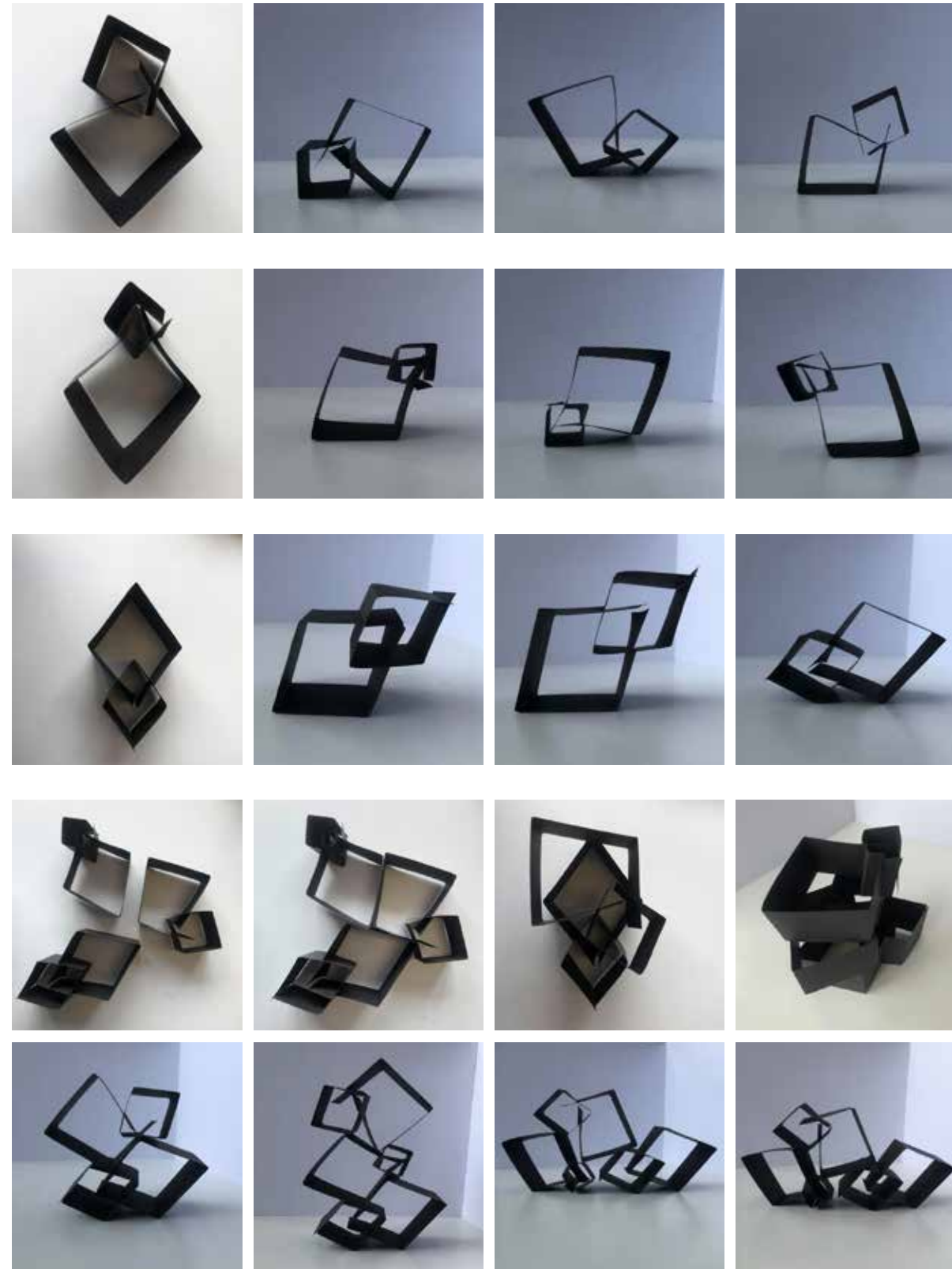
A sixth set of intuitive models displayed how a change in volume can communicate a boundary between spaces. The more obvious the change in volume, the easier this boundary threshold is to notice. Volume changes can be from any direction, as demonstrated in the drawings above where the models have been flipped upside-down to alter volume through the ground plane. Changes in volume, especially the more obvious changes, split the space into primary and secondary areas.

## challenging orthogonal

The seventh and final set of models within this series were photographed individually and then in relation to one another. These models explored ideas of apartment living, overlapping spaces, a change in volume expressing boundary between space, primary and secondary space, and challenging the orthogonal. Challenging the orthogonal refers to both the vertical and horizontal planes. Through this, more opportunity for innovation is created alongside providing more ways in which tactile elements can be incorporated and emphasised.

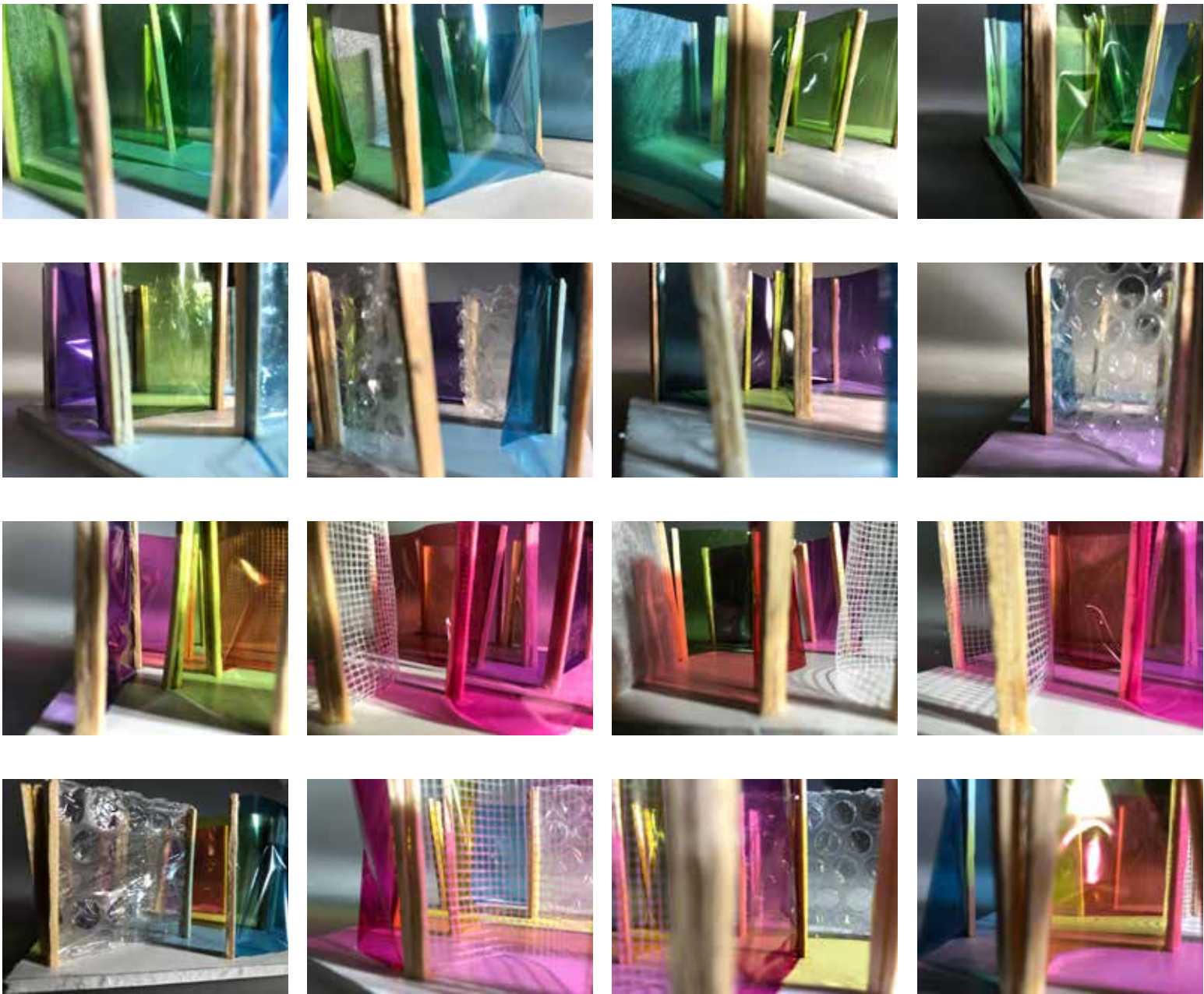
Photos of the models were drawn over to pull out key shapes and to explore how the shapes could create both plans and sections.

Figures.132-133



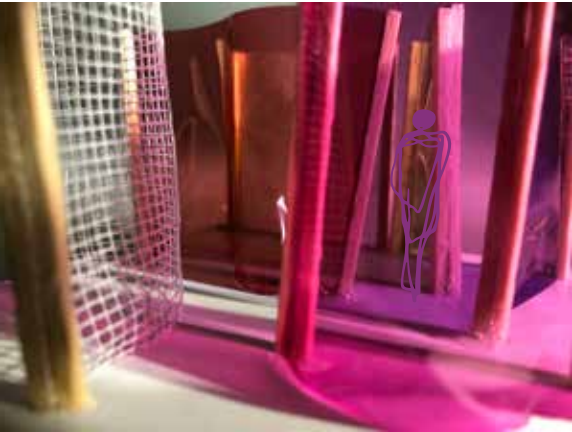
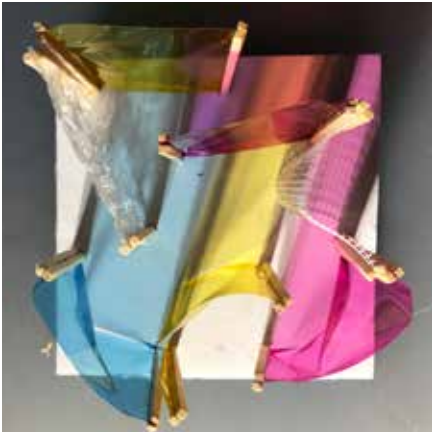
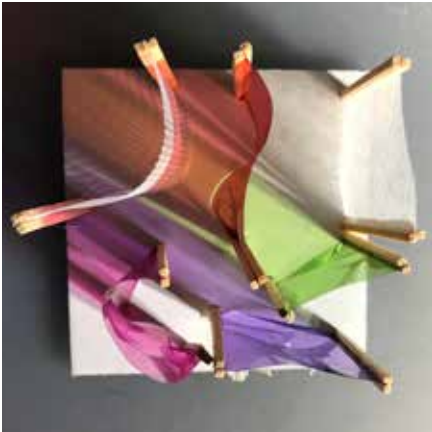
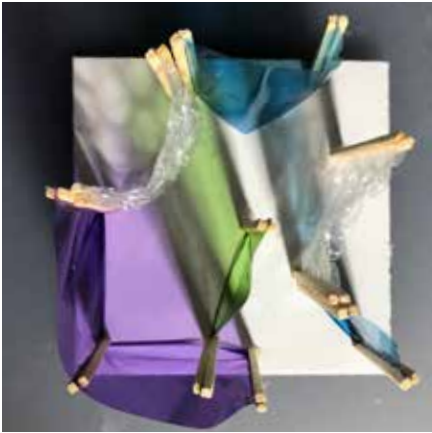
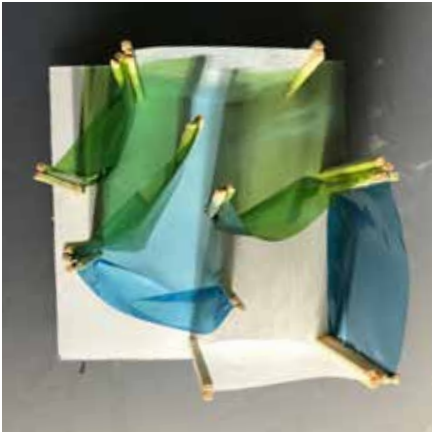


hybrid models -  
light and shadow

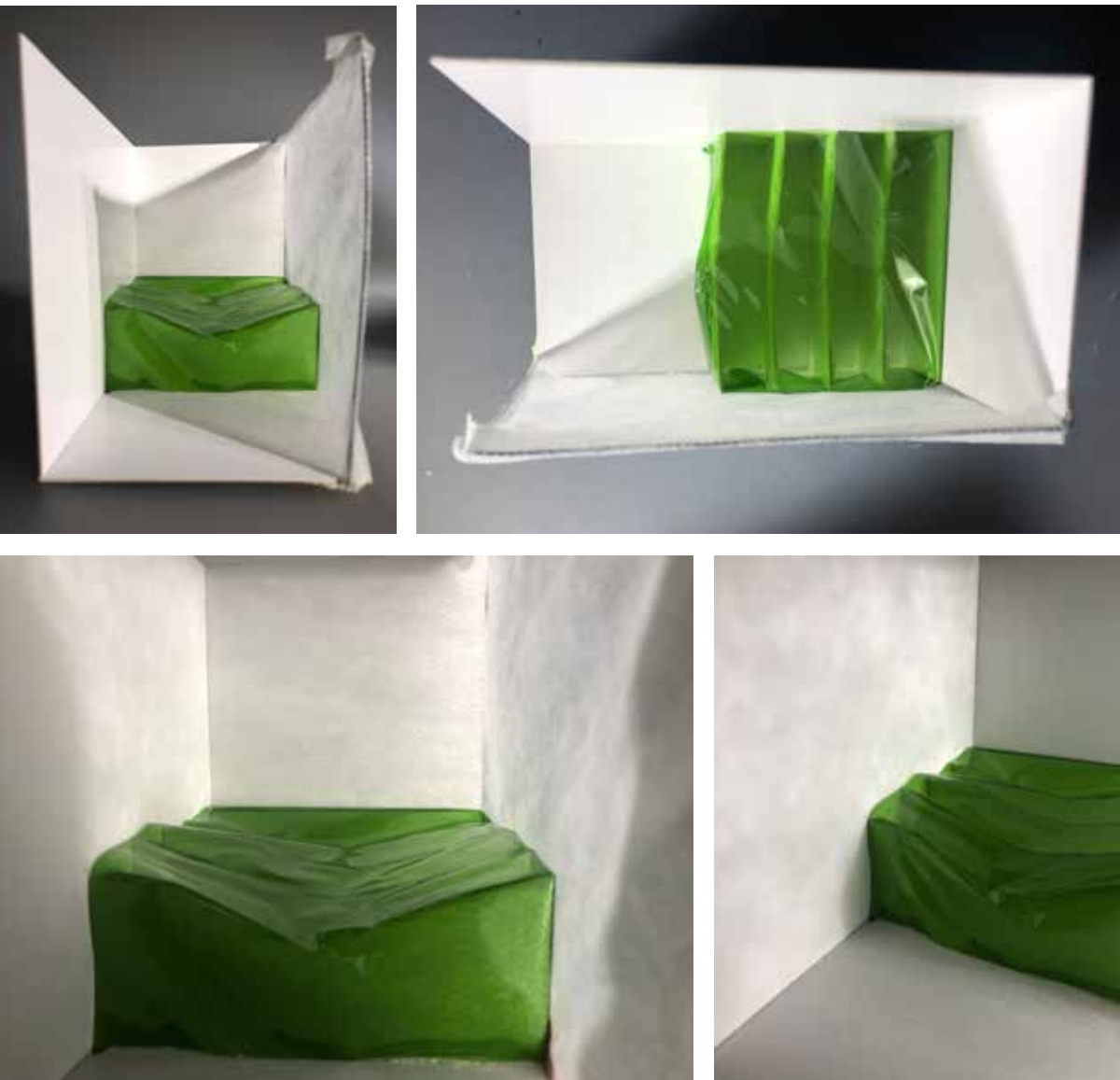
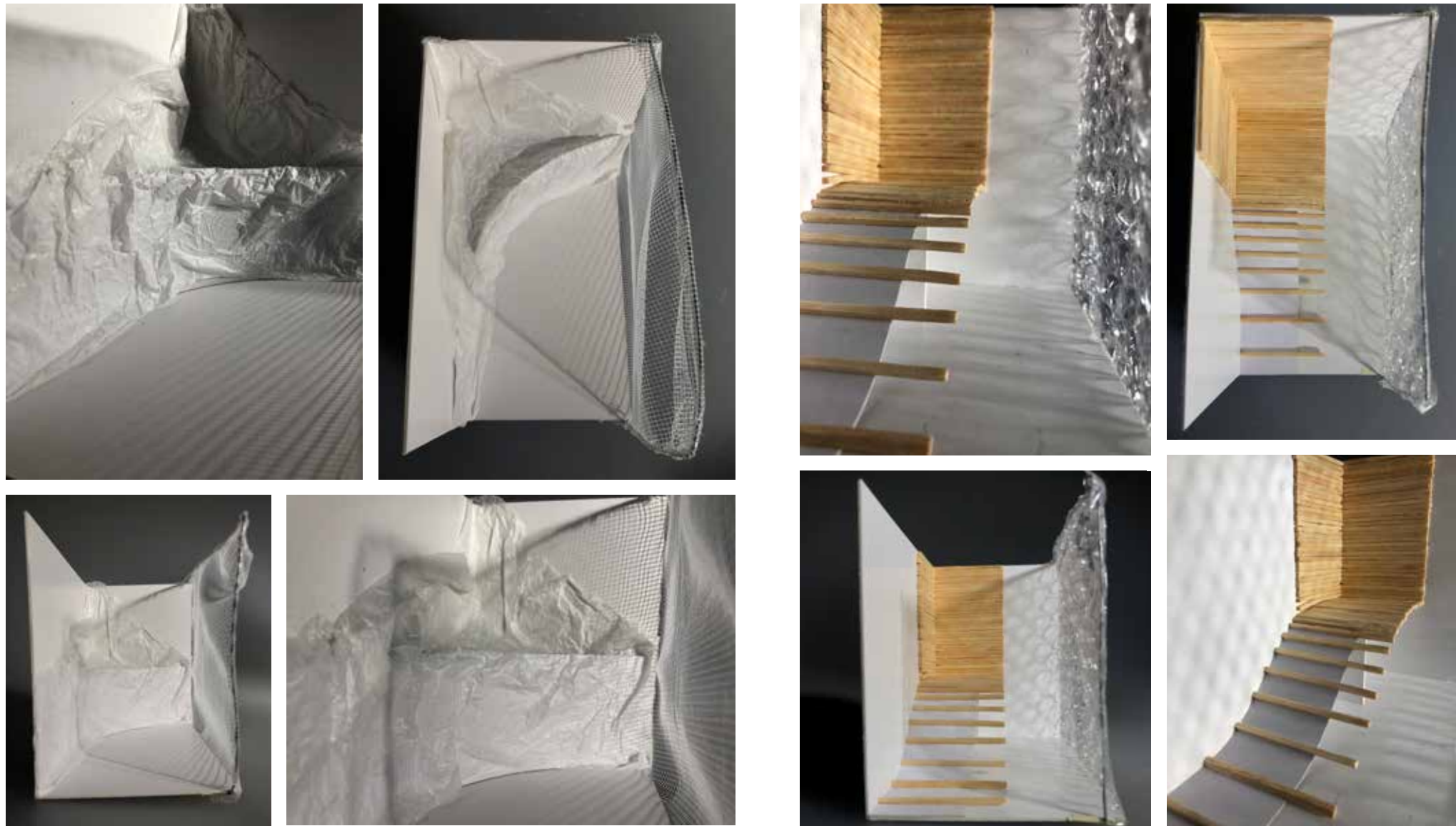


Using the findings from a few of the sets of intuitive model series; these models explored how light shone through different colours and tactile elements can create different spaces, as well as varying levels of privacy.





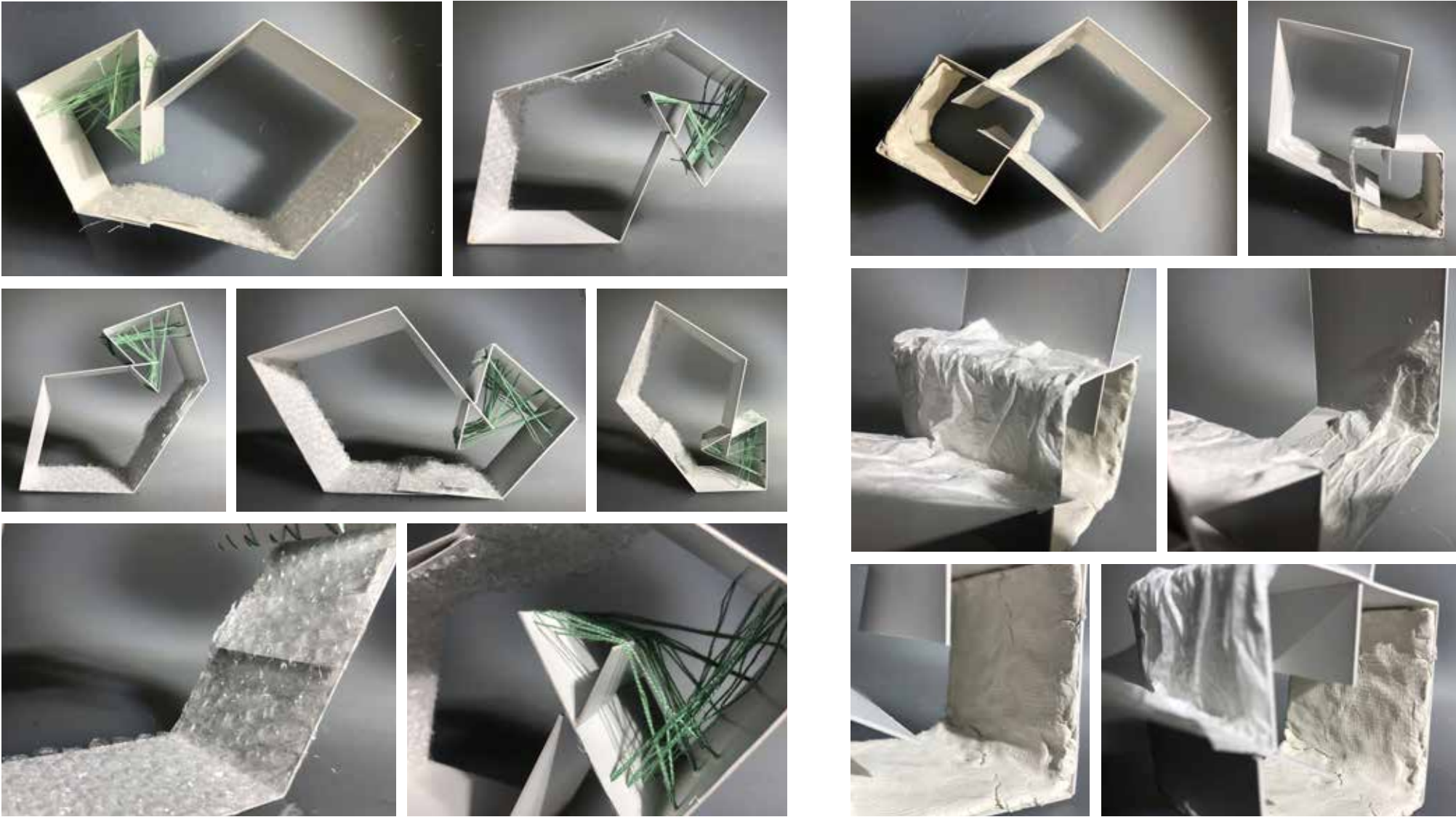
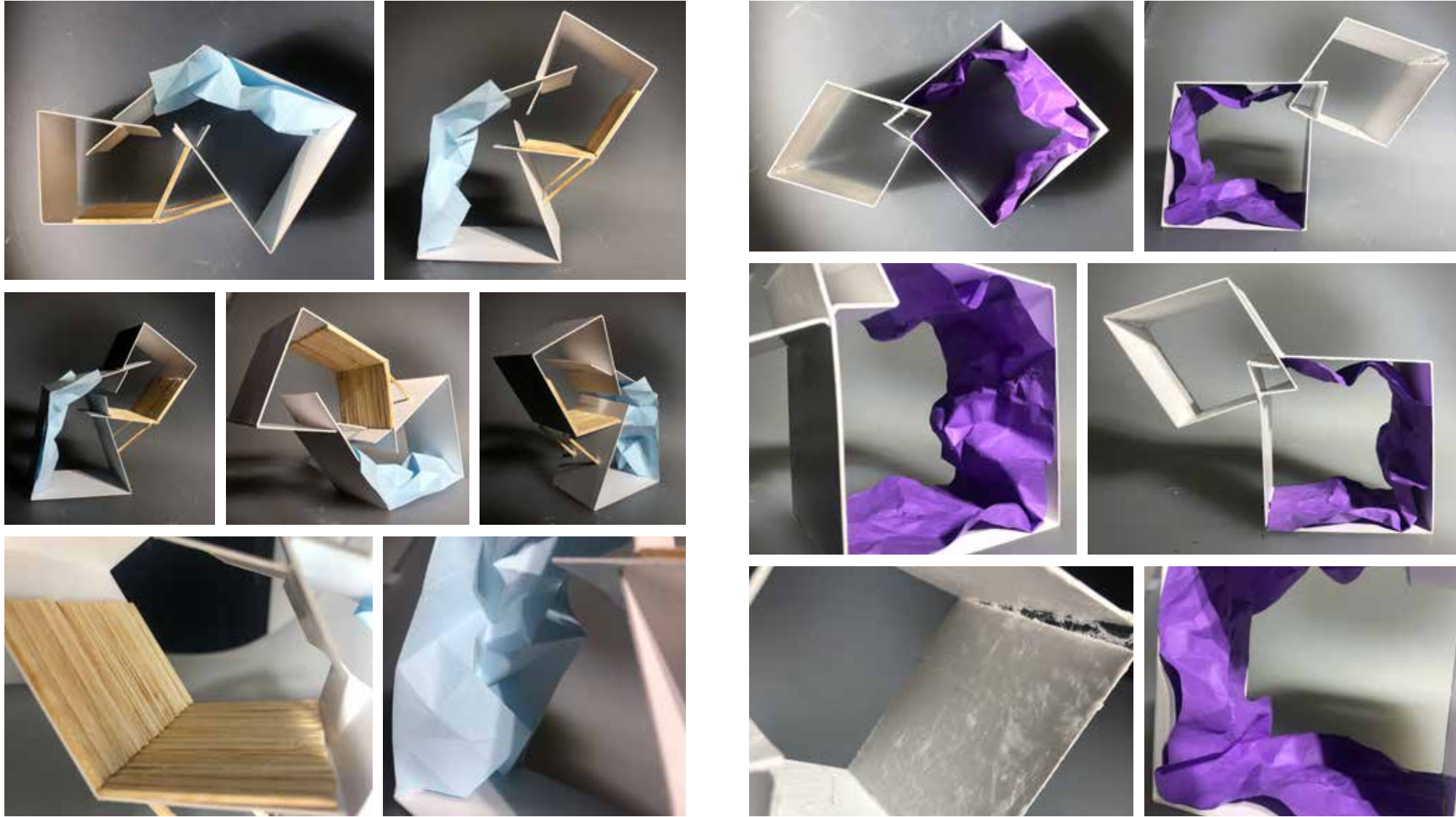
hybrid models -  
volumes, texture, shadow



This set of models combined the ideas from multiple sets within the initial series of intuitive models. They explored how a change in volume, a change in texture, and a change in colour can emphasise a transition between spaces; as well as how light shone through different tactile materials can create unique shadows that can either contrast or enhance the details of the space within.

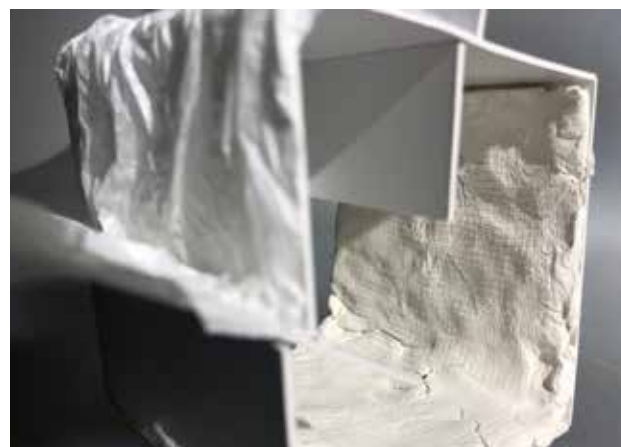
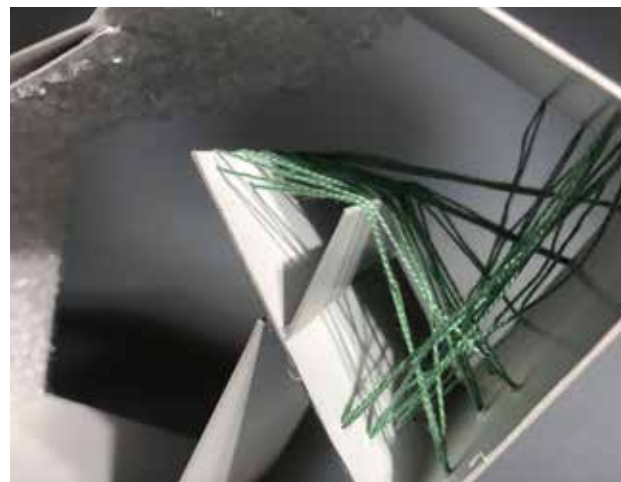
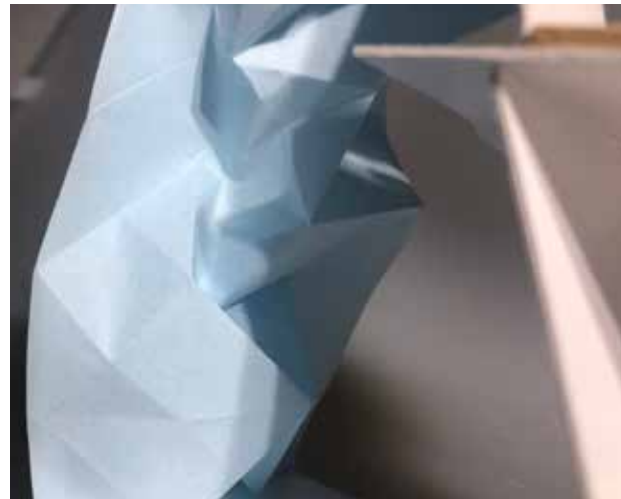


hybrid models -  
volume, texture



The models within this set explored a change in volume, contrasting spaces, the use of primary and secondary space, challenging the orthogonal through both horizontal and vertical planes, linear versus organic forms, and contrasting tactile qualities.





These key images emphasise the contrast in materials and the tactile nature of the surfaces. They focus in on elements of the models that push the boundaries of orthogonal, whether it be through surface texture/shape or angles and non-vertical/horizontal walls, floors, and ceilings. The models also start to discuss how tactile elements being applied to the walls and floor can start to create furniture and functional elements within the space.

Key Findings from Chapter 4

The first conclusion that can be drawn from this body of work is that touch is very abstract when being talked about, so the best way to discuss touch is by actually touching. The first step to design for touch is to make. Be hands on and physically make something.

To fully explore the tactile experience, one must push boundaries in other realms. Challenging the vertical and the orthogonal provide more opportunity for touch, as well as accentuating and reinforcing different tactile elements and their significance. An example if this would be tactile boundaries being reinforced by coloured or visual boundaries.

Embedding ideas and concepts to all scales of design from micro to macro is a vital method in ensuring that they are communicated into the atmosphere successfully.

Projecting light through colour and texture accentuates key tactile concepts, drawing attention to changes of a tactile nature within the space.

Through challenging the orthogonal using this method, and through differentiating spaces by changing volumes, emerge a pattern of primary and secondary spaces. These spaces, especially when contrasting in colour and tactile qualities, reinforce and challenge each other, accentuating the differences by making the occupant more aware of the change.

These findings lead to a few precedent studies that explore these themes more. Through these the findings from previous chapters were reinforced. It was also found through these that it is possible to go too far with the design and oversaturate it using this method. This is great to begin with as it inspires elements of the design that would otherwise not be thought of; however for practicality the next step would be to edit back down.

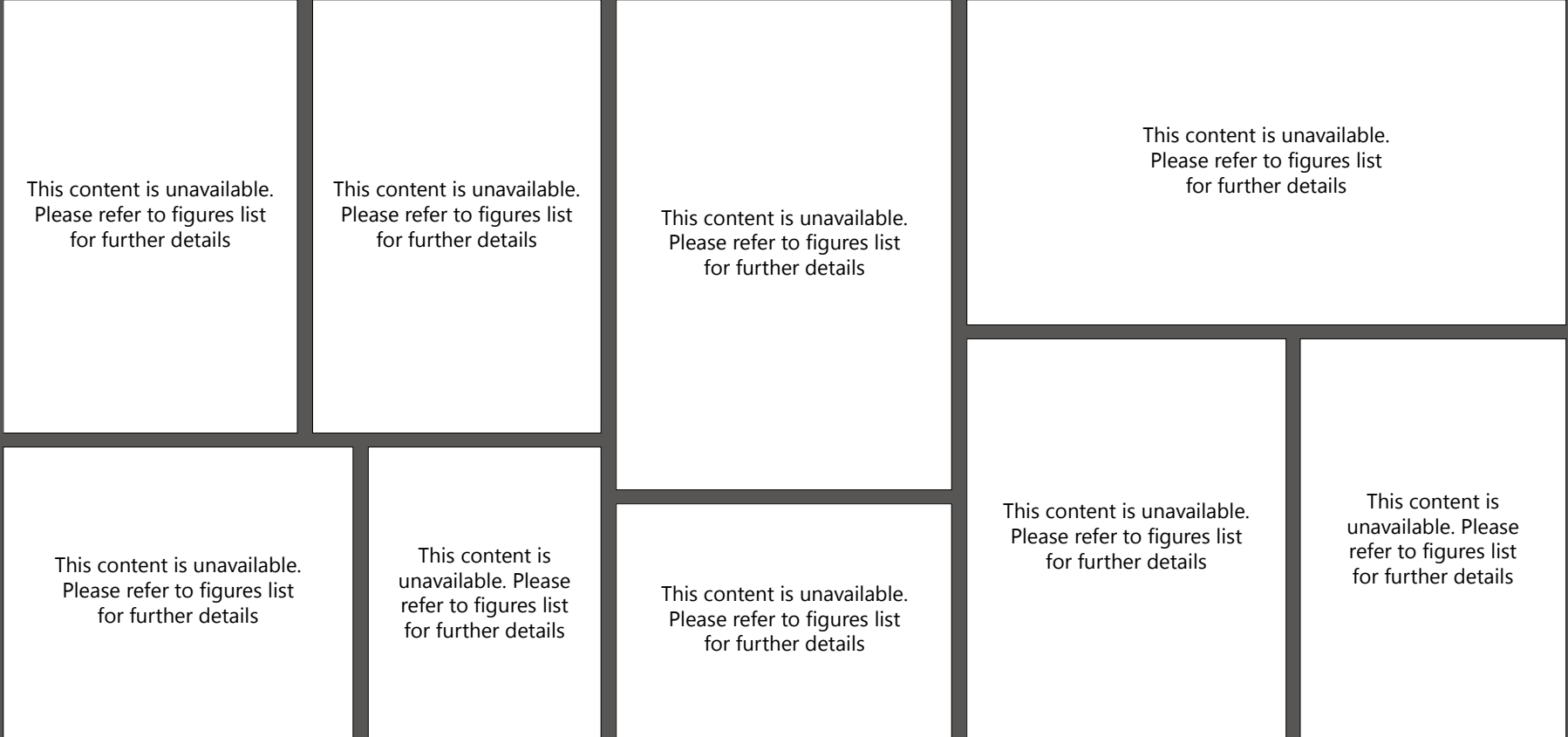
- To be considered for framework:
- Challenge vertical and horizontal planes / challenge orthogonal
- Contrast accentuates different tactile elements
- Embed ideas on all scales - micro to macro
- Design by making and touching
- Oversaturate then edit down
- Projecting light through colour and texture casts shadow that accentuate/reinforce contrasting spaces/key concepts

# New Kyoto Town House

Alphaville Architects

Located in the center of Kyoto, this is a residential town house designed with the intention of creating an enjoyable and comfortable space whilst overcoming the drawbacks of the standard townhouse of the area. A more traditional Kyoto town house would have a darker interior, with external openings and internal spaces being limited by the wooden structure. The New Kyoto Town House, however, pushes the horizontal and vertical planes. It spreads across three floors, with a set of polyhedral partition walls connecting the rooms between the floors. These partition walls distort boundaries between rooms, as well as almost blending architecture and furniture together. They encourage movement and play throughout the house. The ply-wood finish of the walls and surfaces combine with large openings in the walls and floors to allow in plenty of natural light, and to softly reflect and diffuse it in all directions, especially towards the interior. ("NEW KYOTO TOWN HOUSE")

This precedent challenges the traditional orthogonal frame of buildings which is very relevant to the findings from the series of models made throughout this chapter. The partition walls within the house blur boundaries of wall, floor, and ceiling; connecting them together and creating furniture in the process. This backs up the final set of models for both series that discuss how challenging the orthogonal and using tactile elements on all surfaces provide more opportunity for innovation and methods in which touch can influence design.



Figures.146-154: Interior views of the New Kyoto Town House



# Tato Architects

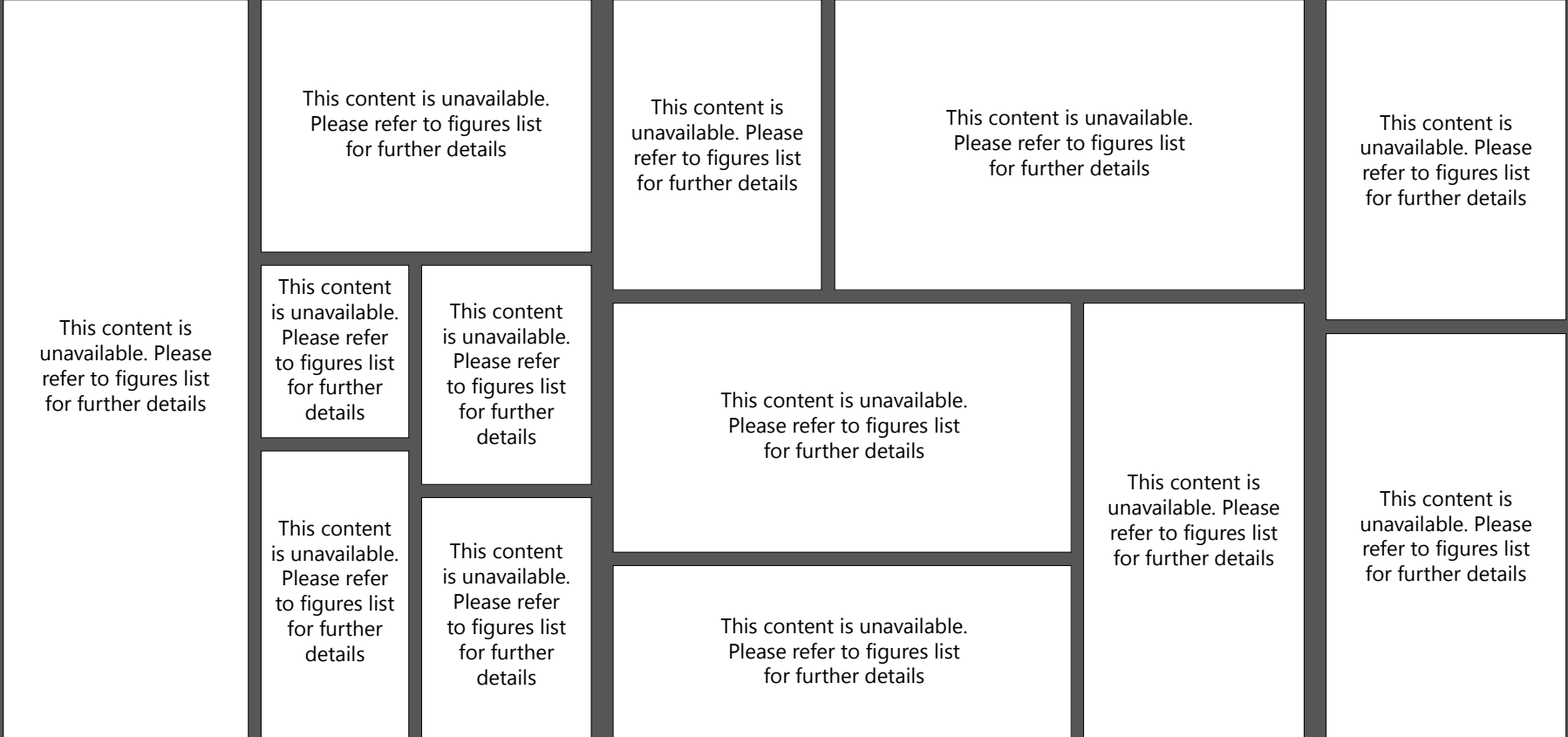
Tactile architecture   challenging orthogonal

Tato Architects has been running since 1997 and primarily works on private residential housing in Japan, with a few interior and installation projects over recent years as well. Three projects by Tato Architects are shown in the images to the left. These are ‘House in Miyamoto’ in Osaka, Japan, 2017; ‘House in Takatsuki’ in Takatsuki, Japan, 2017; and an exhibition of their works called ‘reorganization’ which was set up in Tadao Ando’s ‘House in Nihonbashi’ in Osaka, Japan in 2020. (“Tato Architects - About”)

due to structural restrictions, which limits the visibility between rooms. This creates a cave-like labyrinth that gives only glimpses of what spaces lay around the corner. (Meghna Mehta; HAN Shuang)

These houses are relevant to this research due to their challenging of the orthogonal, pushing the horizontal plane through the fluctuating floor levels and non-standard floorplan. The quantity of functional and usable space is limited with this method though. There is also a lack of safety and privacy within the design for House in Miyamoto, which although wasn’t a requirement within the brief for the house, would be far less desirable in New Zealand culture.

House in Miyamoto and House in Takatsuki both use a flooring arrangement that is continuous and stepped. They were created by laying a diagonal grid at a 45° angle over a rectangular shell. The idea behind this method was inspired by an uneven ground on a site, as well as the intention to divide space into various functions while keeping the spaces connected. House in Miyamoto consists of a single space with few walls and designated storage spaces. This ensures the family of three within have more interaction with each other in order to feel close and less lonely. It has a total of 13 floors floating at different levels, each with a height difference of 700mm. This allows floors to also be used as tables and shelves. House in Takatsuki consists of 16 different floors in a similar composition to House in Miyamoto, with the floor raising up in two spiral shapes which meet in the middle to form the kitchen and living space and separate again as they move towards the roof. The spaces between the floors for this house were closed off



Figures.155-160:House in Takatsuki by Tato Architects

Figures.161-165: House in Miyamoto by Tato Architects

Figures.166-167: Exhibition ‘reorganization’

# CHAPTER 5

## MAP OF HOW TO DESIGN /

## FRAMEWORK AND APPLICATION

This chapter uses the findings and criteria found throughout the previous chapters, combining them into a procedure, or framework. This framework will map out a series of steps that, when applied to the design process, will result in a space designed primarily using touch and tactile methods to drive the design forward. This framework will be tested through designing a small house in New Zealand that fits the criteria found in earlier chapters. It uses tactile methods to create a tactile home. This is done under the assumption that the home will be experienced through bare skin.

The strategy behind the framework will be two pronged, with three levels of considerations. There will be key elements of what to consider when designing small space living through touch; and there will be a set of steps to follow to create the design.

The primary considerations involve touch - looking at volume, surface composition, and surface texture/material. The secondary considerations are to do with sight - how light, shadow, and colour can be used to compliment and accentuate tactile elements of design.

The tertiary level of consideration is to ensure the restrictions from chapters one and two.

The framework will be tested through designing a home under 76m3, and within a footprint of 37m2. The KODA model of tiny housing will be brought back in as a starting point for designating volumes per space, as well as their general location in relation to each other.

A key tactic for this process is oversaturation - creating a design that is completely oversaturated with tactile and visual elements and then editing and refining it down to create a functional and usable small home. This enables the design to be pushed further without restriction, leading to a more creative outcome.

The experience within the home is intended to be comforting, calming, and peaceful; evoking emotions of happiness and love. This means using softer or smoother materials where relevant, and creating forms that reflect the activities they are intended to house.

# The Framework

There are five stages to this framework that, when applied as a design process, create a functional small home with considerations for touch embedded throughout. These stages are:

1. Volume is looked at and the general layout of the home is established.
2. Tactile spaces: exploring the interior surfaces of each zone within the home, and seeing how these surfaces can alter the experience of space and dictate functions within them.
3. Threshold: to develop the connections between spaces,
4. Oversaturation: where colour lighting, colour, and materiality and visual techniques are used to enhance and emphasise the tactile techniques.
5. Extraction: the oversaturated and intense design gets edited down and developed into a final functional design of a small tactile home.



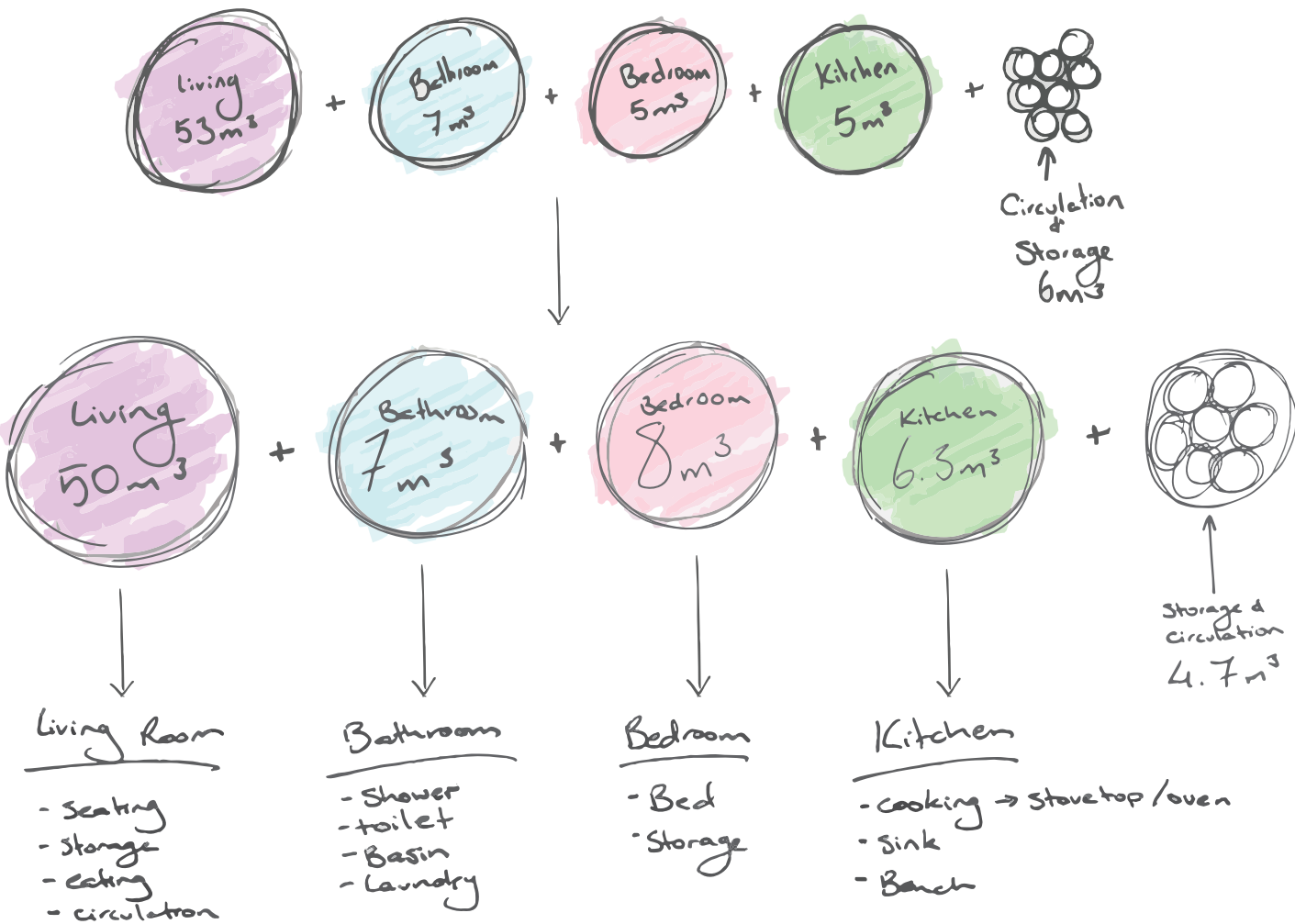
Figure.168



# Stage 1 : Volume

This stage involved creating a general layout and overall volume.

From the KODA base layout, general volumes of overall and individual spaces were extracted. The KODA model was used as a starting point to inform the overall location of spaces within the design layout, as well as the approximate volumes for each individual space.



The KODA volumes and their respective locations were marginally modified to increase functionality.



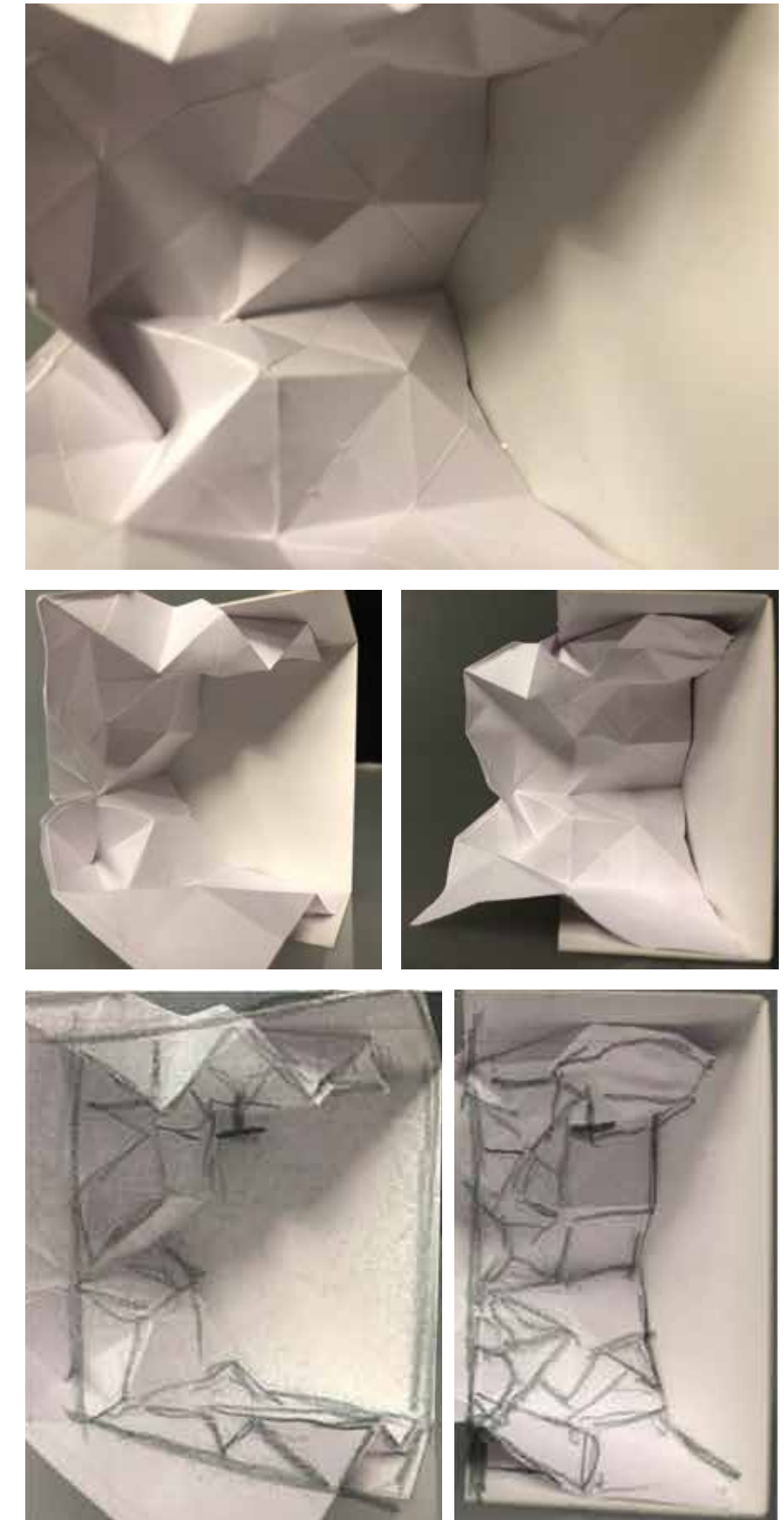
Figure.169

## Stage 2 : Tactile Space

The second stage was the design of each space. Each room was looked at individually. Starting with private and moving to public spaces, tactile methods were used to model the designated spatial volumes. Paper was then used to create a tessellated or organic form reflecting the function of the room.

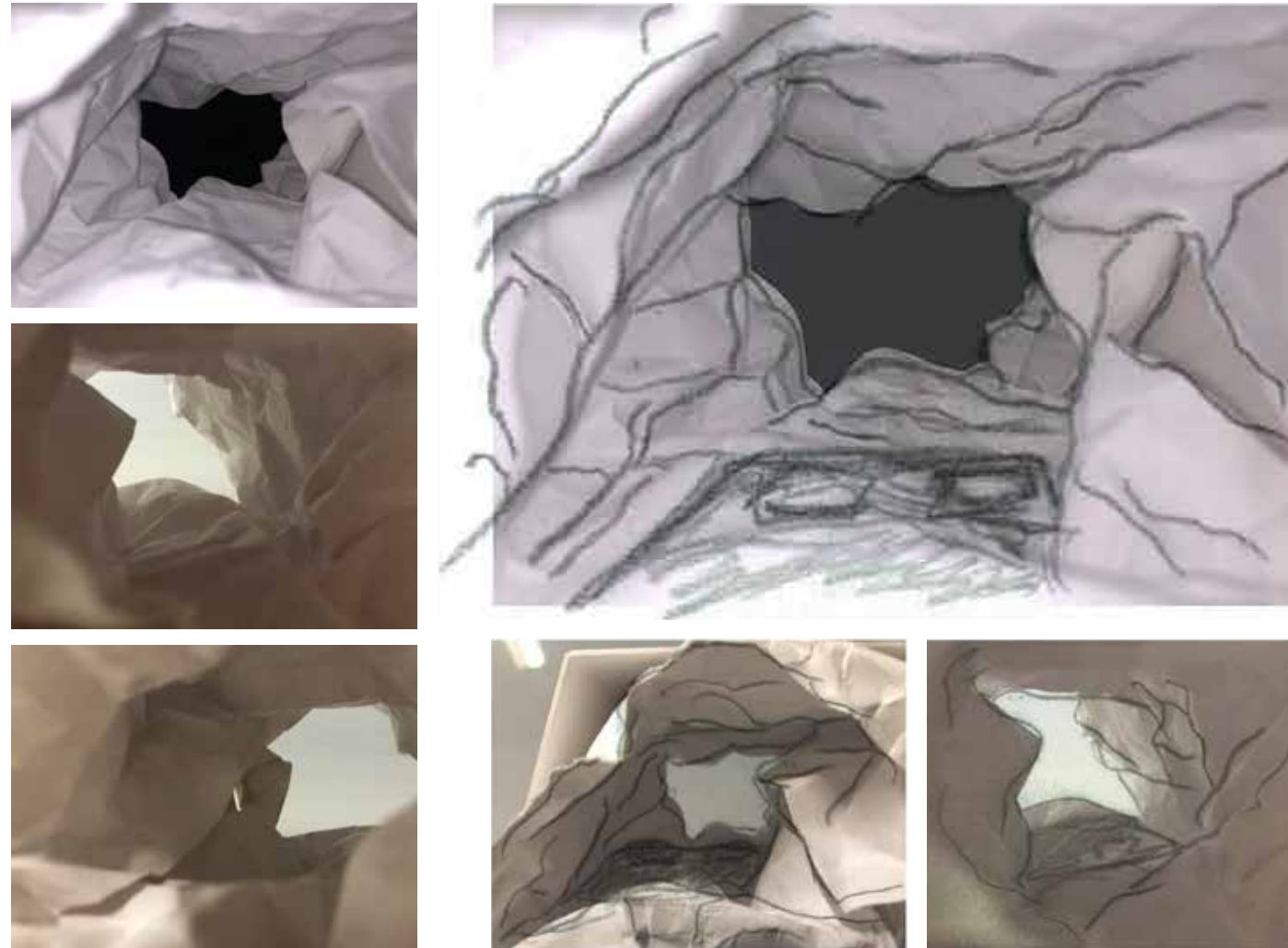


The bathroom is an area of hard and smooth materials for practicality and a feeling of cleanliness. Using a tessellated or geometric pattern would reflect this and can begin to form the basis for shelving, a shower, and basin.

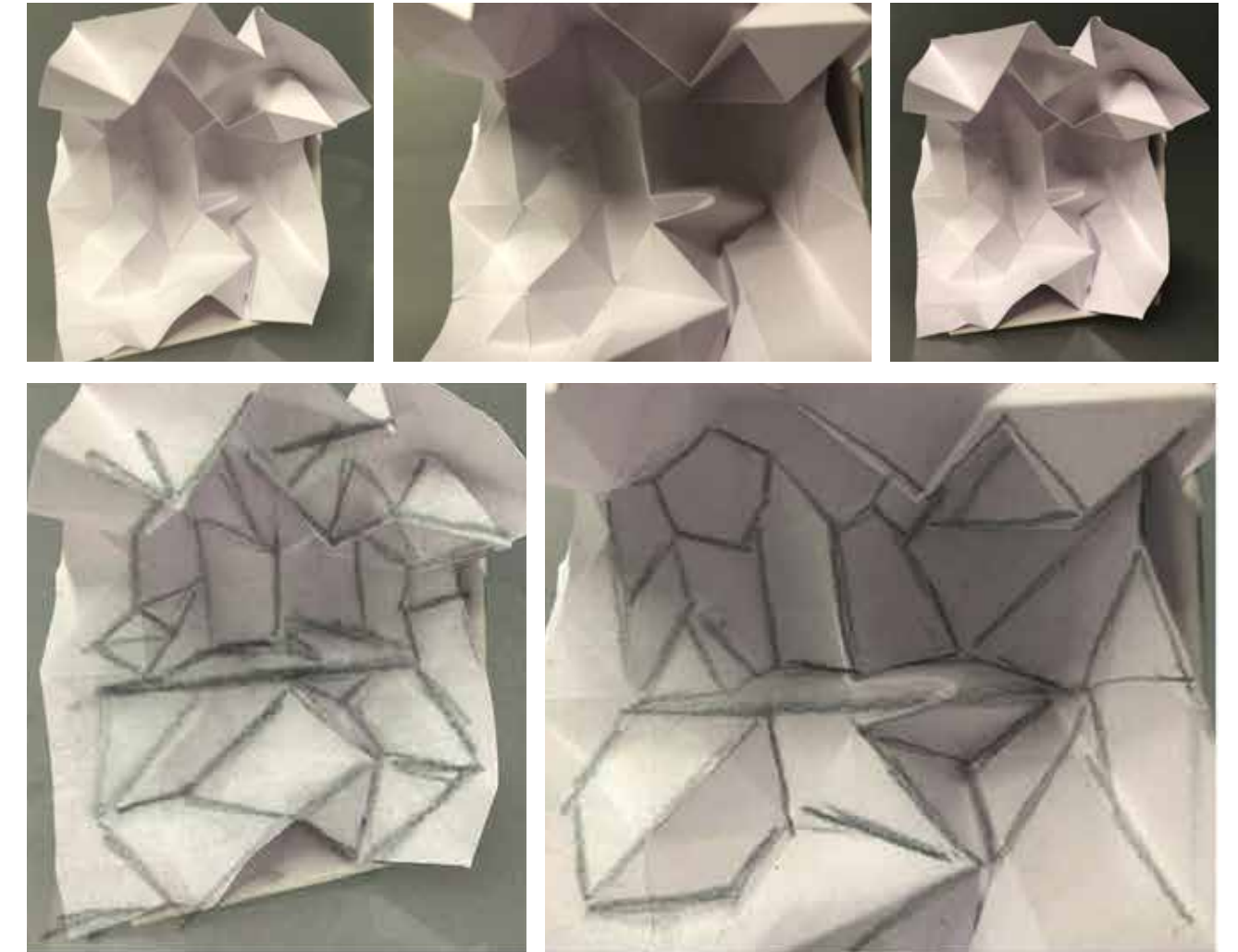




The bedroom is a very private space. It should be cosy, soft, and warm, enveloping the body like a cocoon with cushioned organic forms. It will be small and built around the bed.



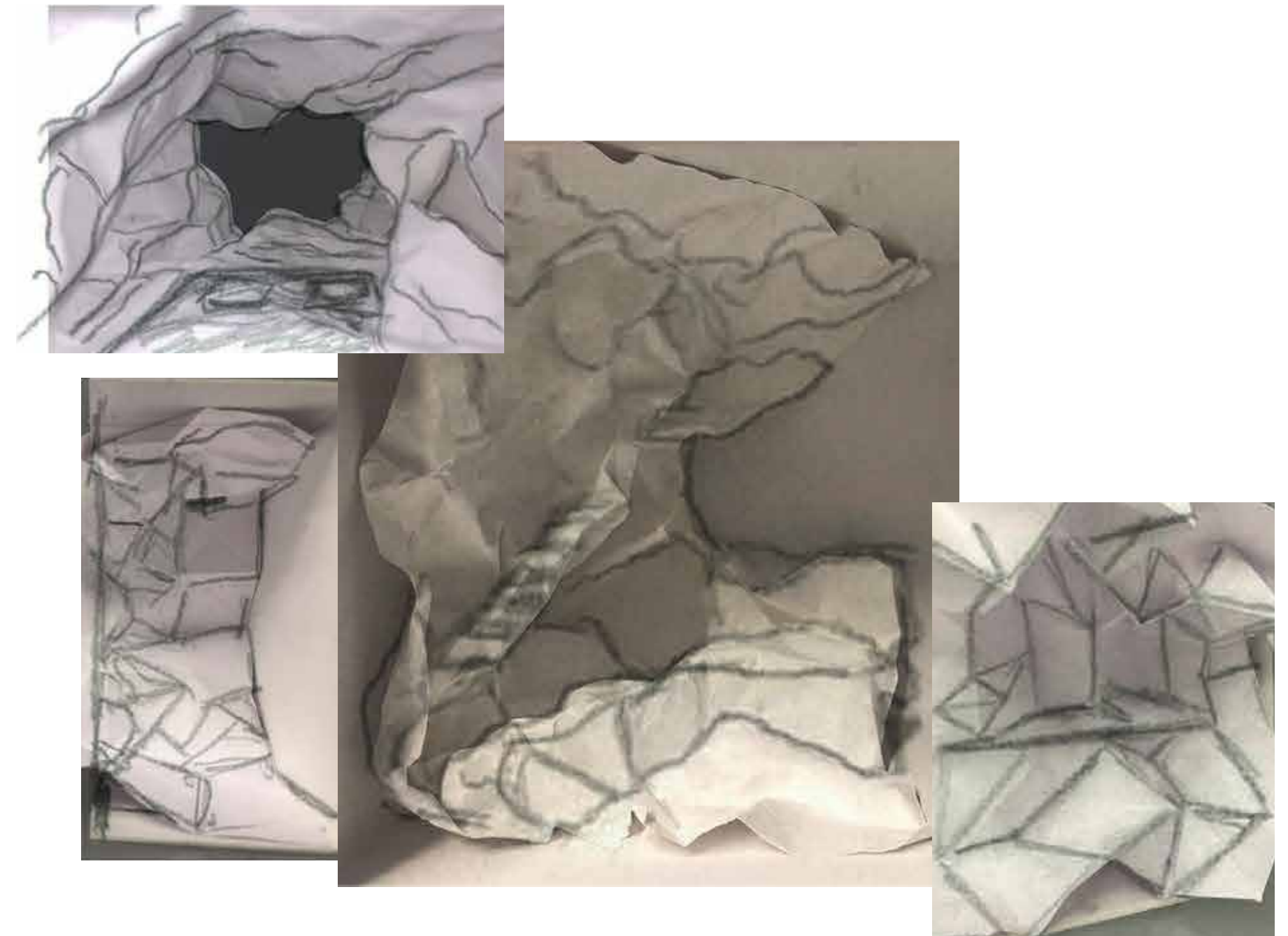
The kitchen will require smooth and hard surfaces for food preparation and easy cleaning. Using geometric or tessellated forms to create the counter-top and shelving would provide a sense of cleanliness and be more practical than anything with more organic flowing forms.







The largest space of the home is the living room, where most time would be spent. This area should be comfortable and relaxing. Seating and storage could be created with soft and organic forms. These forms could also facilitate the changing of levels and movement through space with the right kind of structure underneath.





These forms were a good start in initiating the design process, however they did not push the orthogonal elements enough. They were much less interesting than earlier iterative models so, using elements and methods brought forward from the previous chapter, another model was created to reimagine the composition of surfaces.

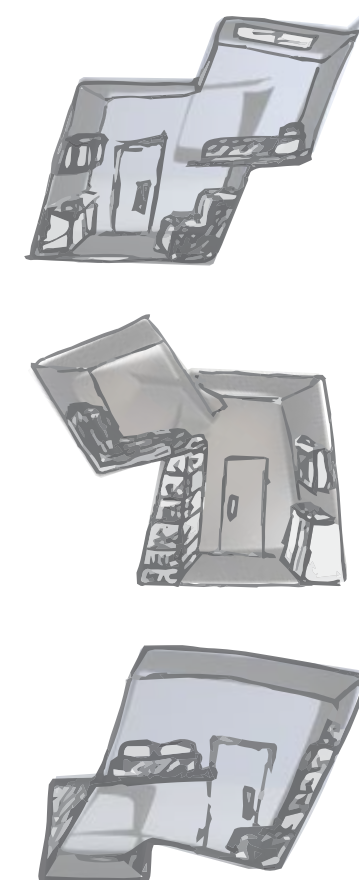
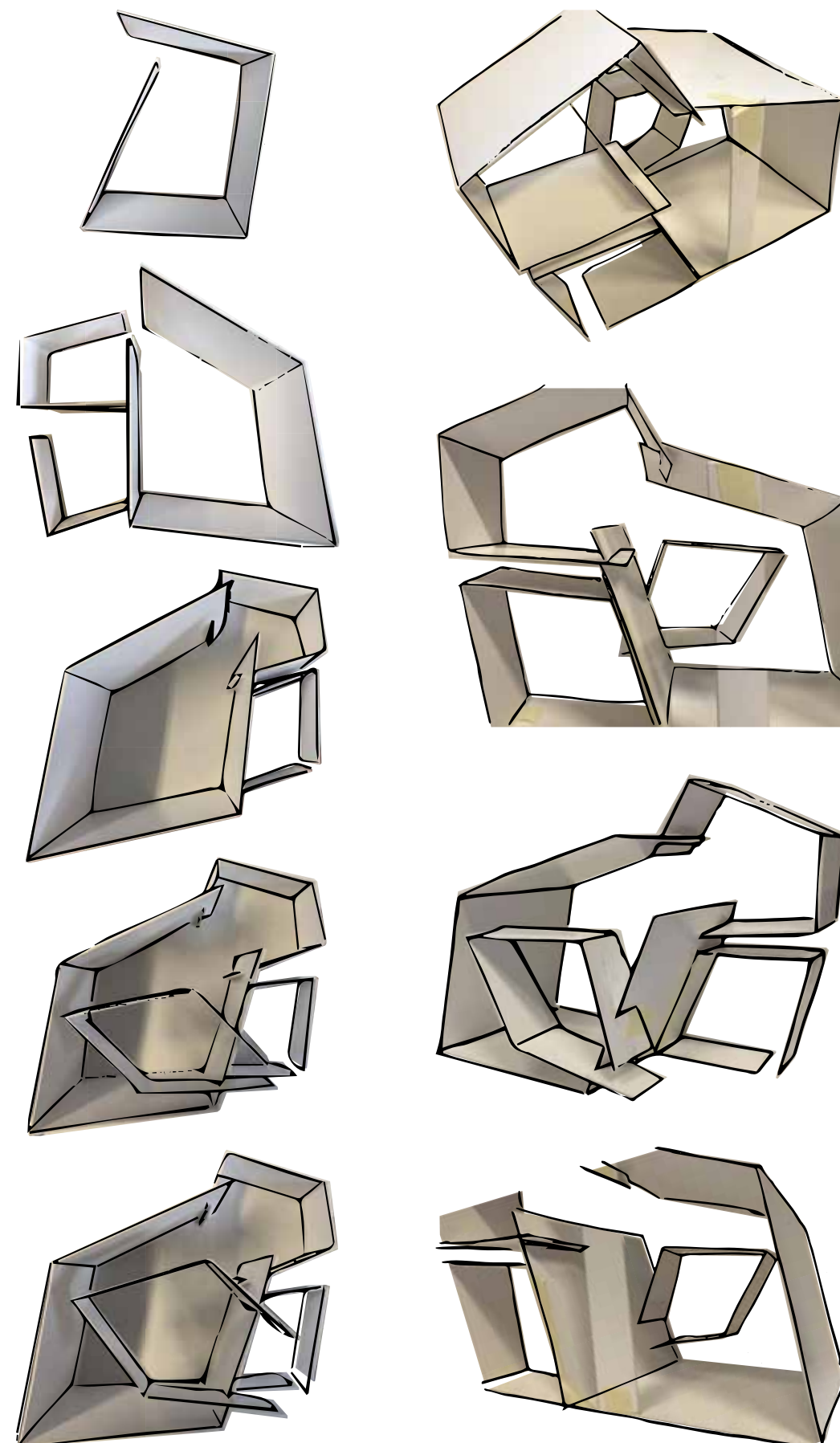
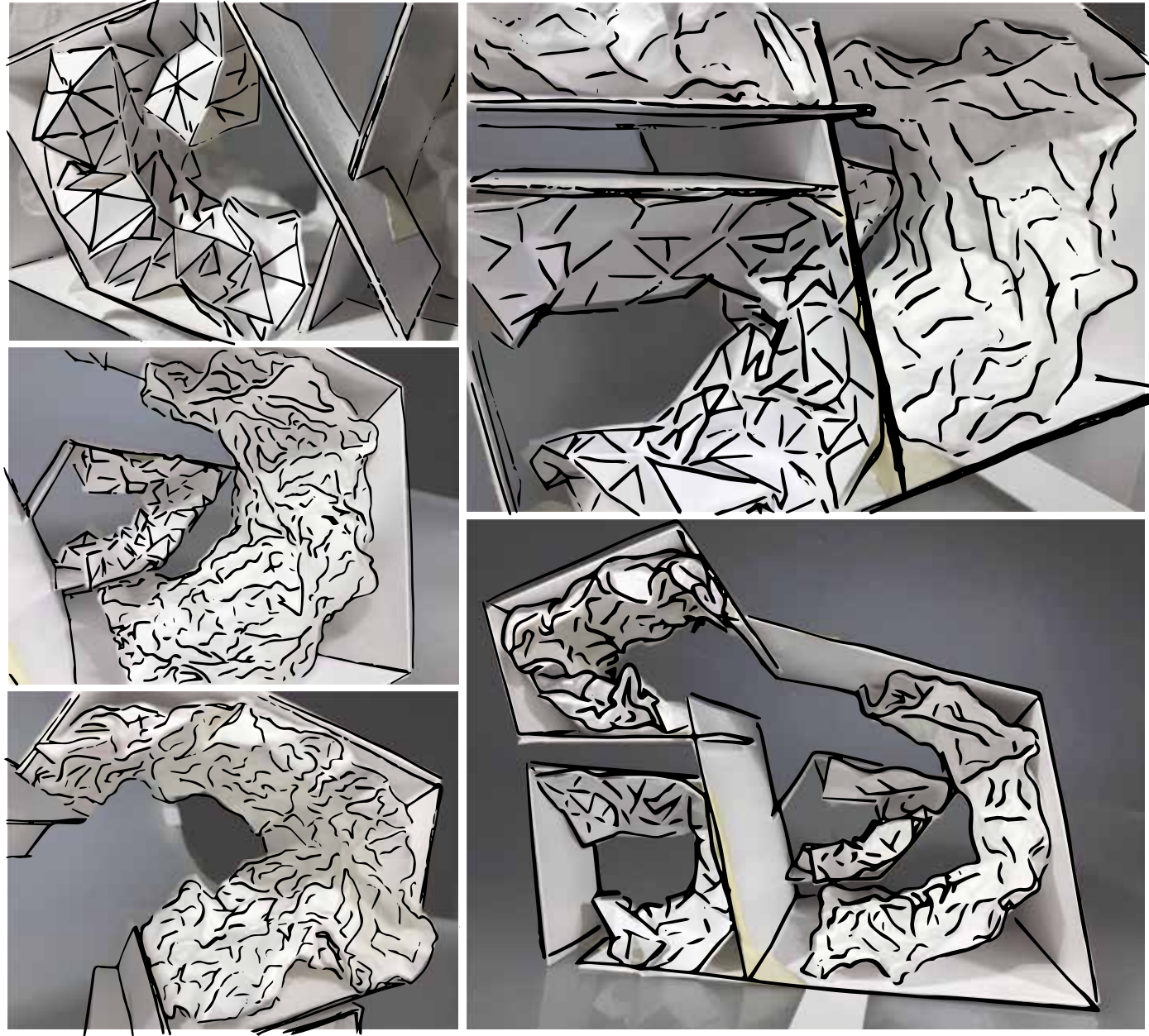


Figure.175:Reference images from chapter 4 that inspired this step of the process

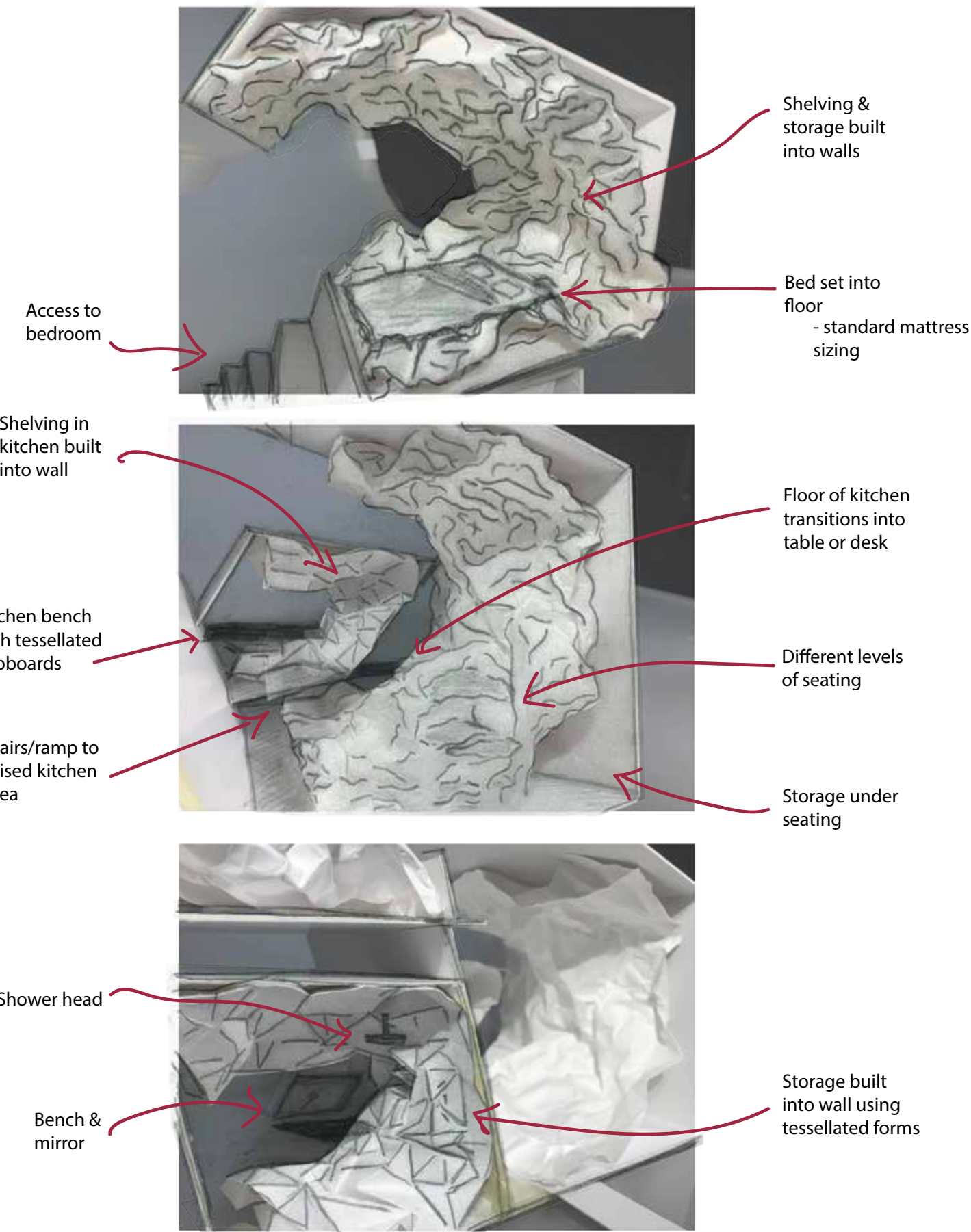


This method created an overall volume, with each space taking a unique shape. The cubic meterage within the volume will likely have expanded, however this is recalculated and adjusted accordingly in stage five where the design is refined and edited down. Within this overall volume, the rooms were focused on individually again, applying tessellated and organic forms in a similar manner to the first set of models within this stage.

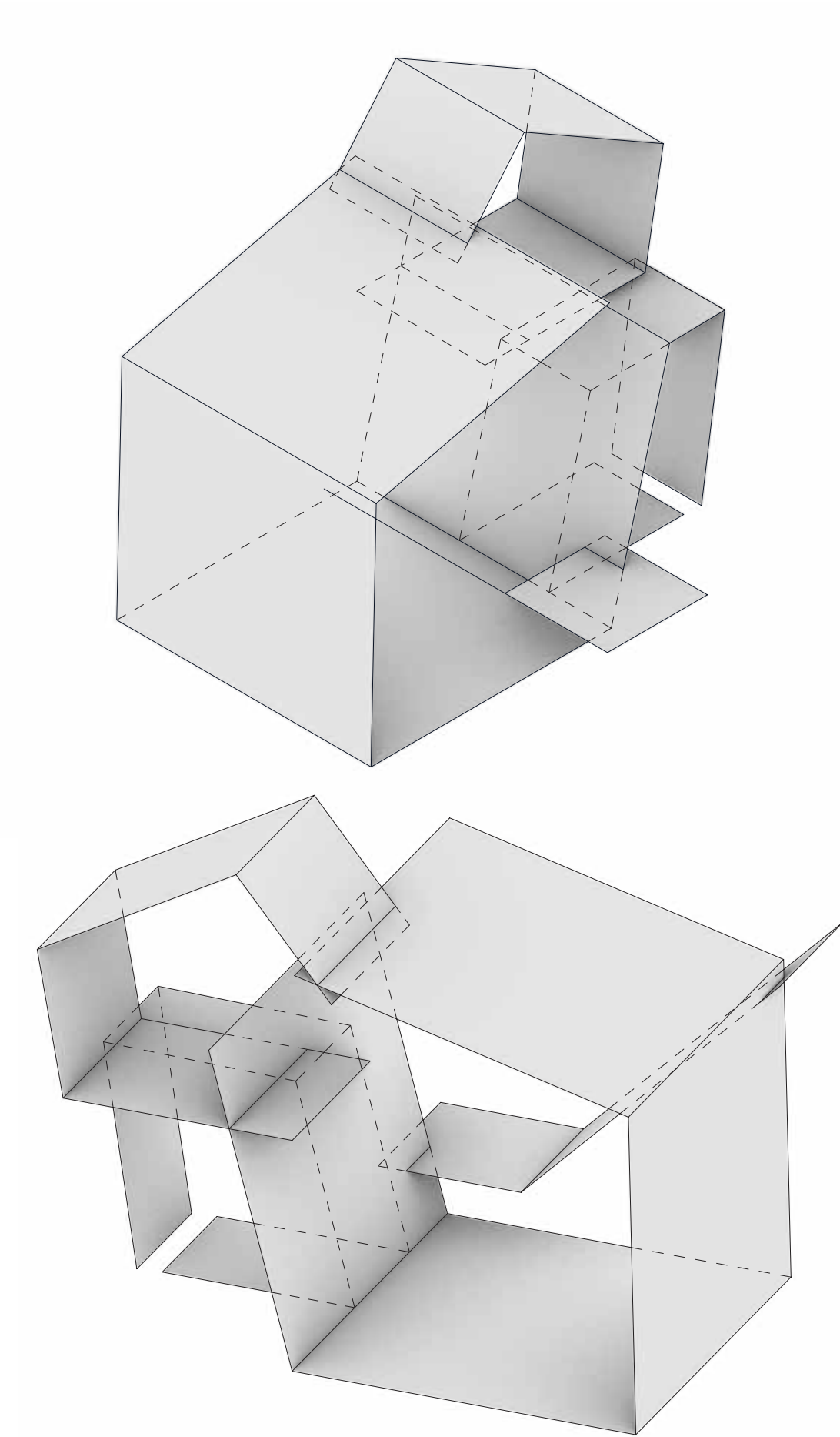




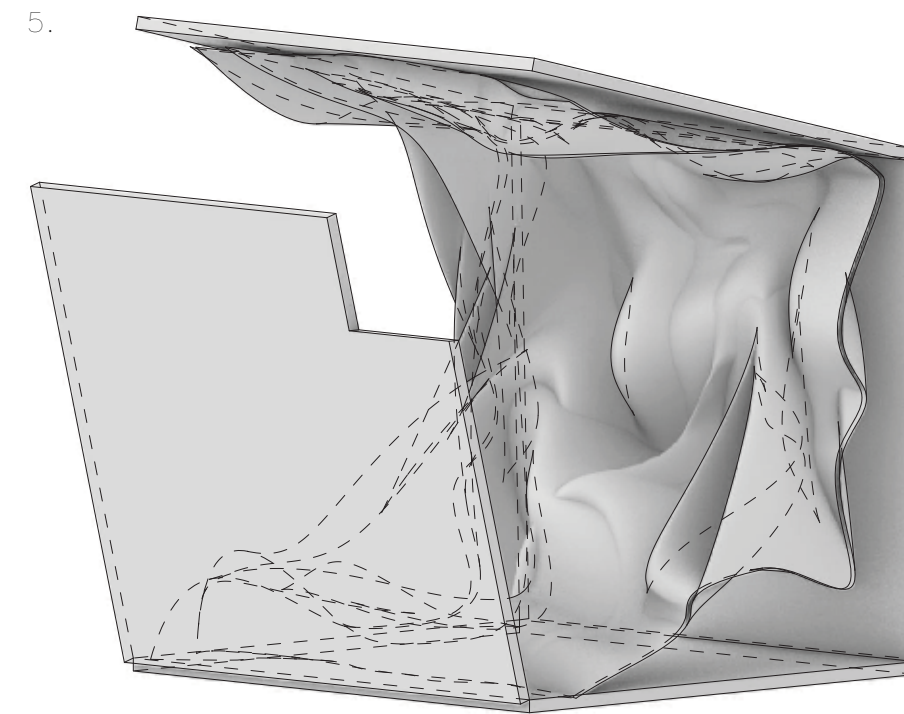
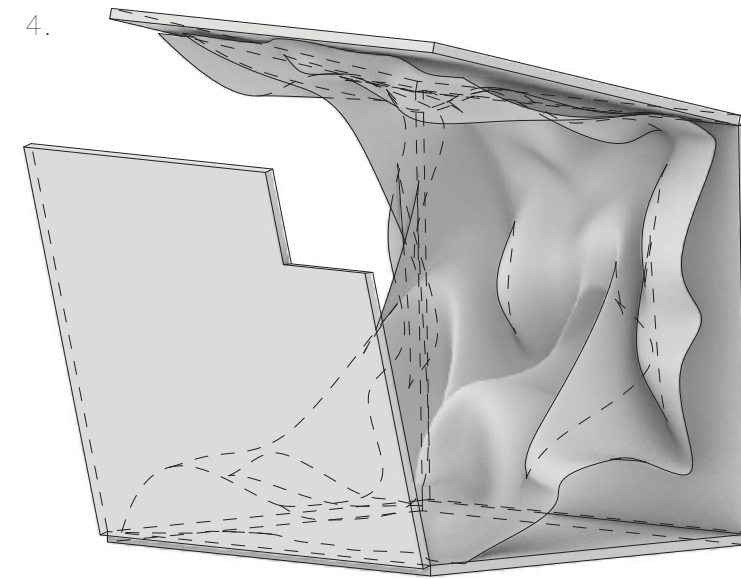
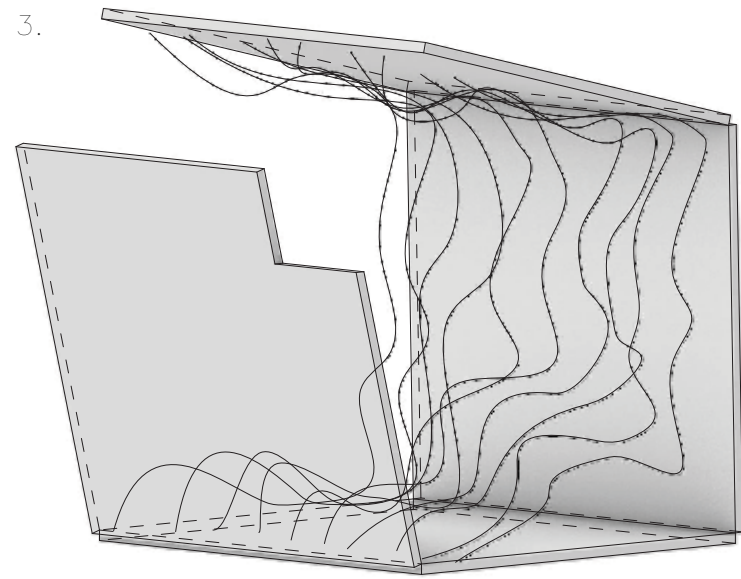
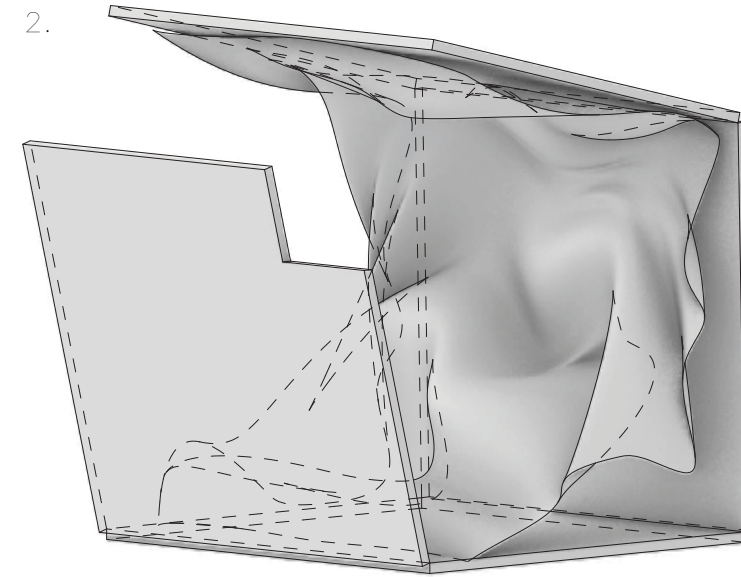
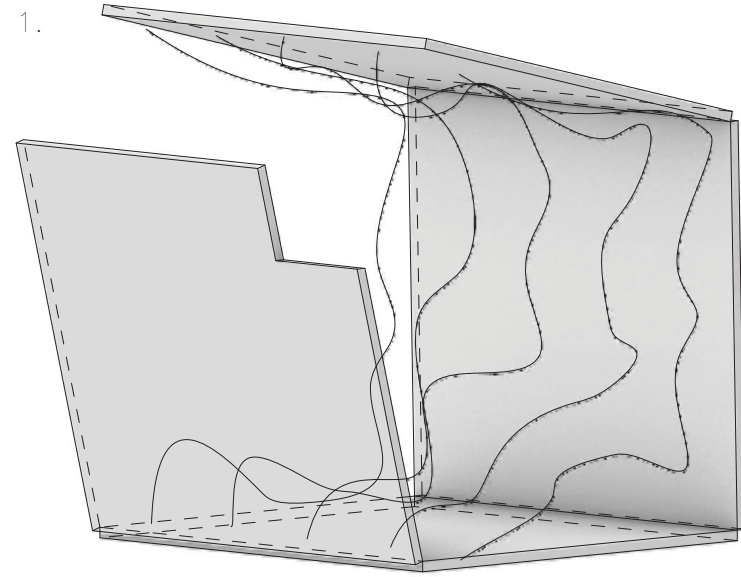
The resulting model was photographed and drawn over to pull out key forms and to emphasise the contrast between spaces. Drawn analysis of the forms also helped to determine where certain functional elements should be located.



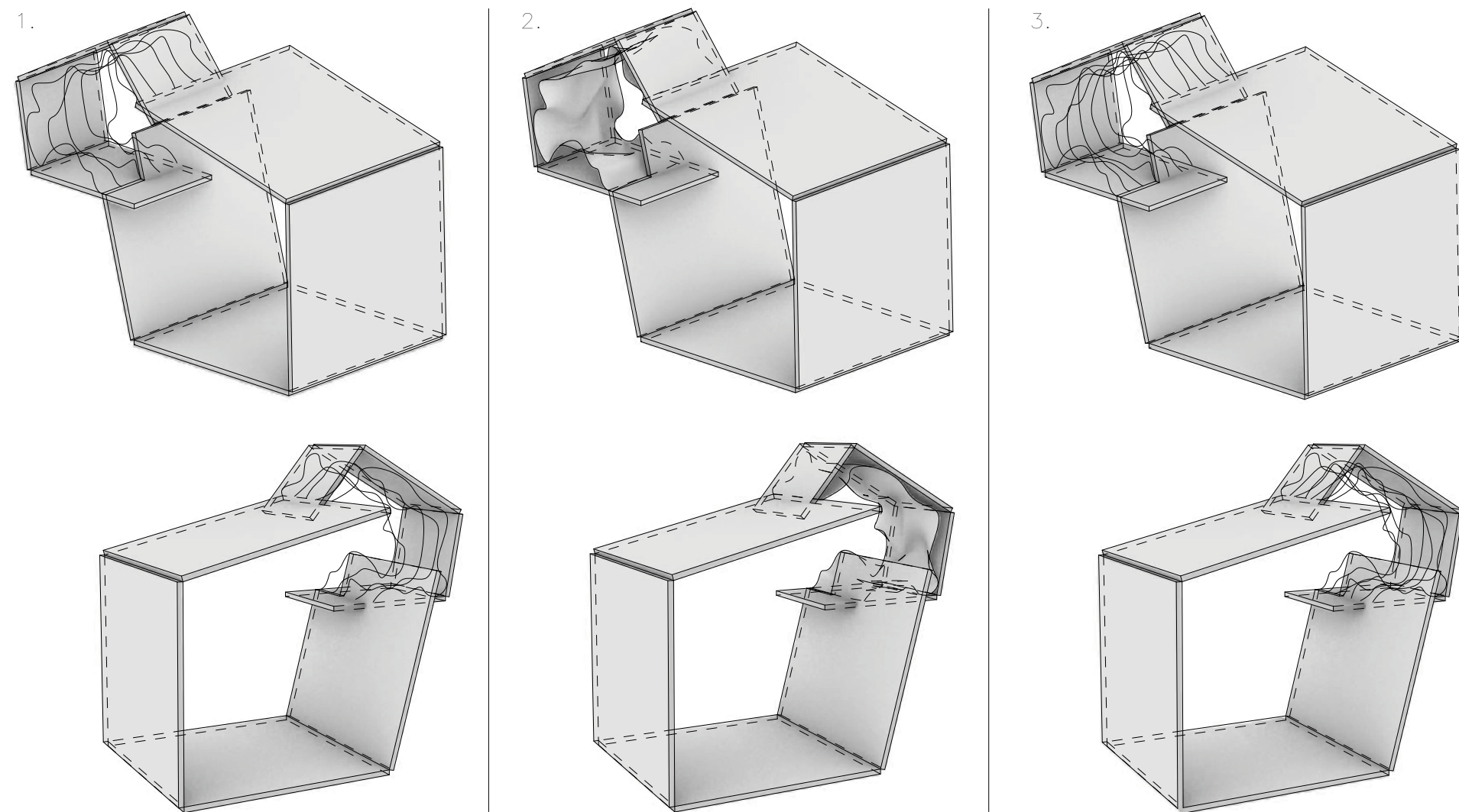




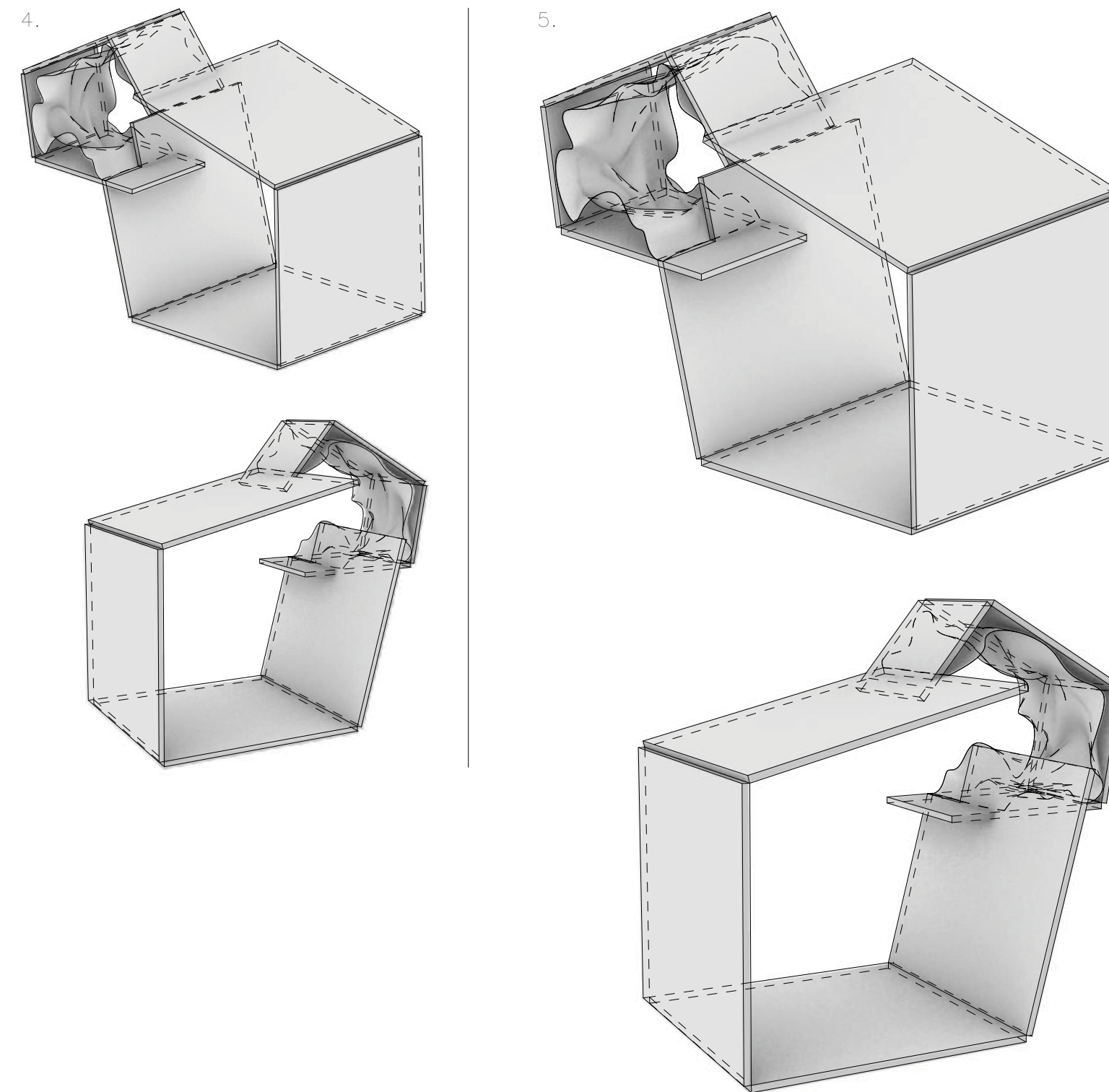
The volumes were modelled in the computer in order to set scale and dimension to everything, and to be able to edit them more easily. This computer modelled design was kept as close to the physical model as possible. From here each room was focused on individually, creating polysurfaces that mimic the paper forms of the physical model.



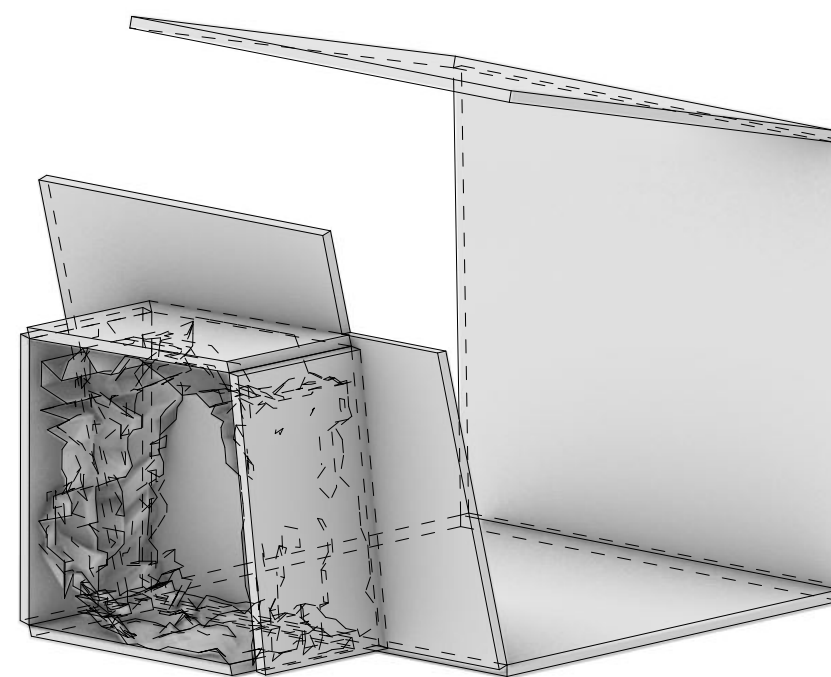
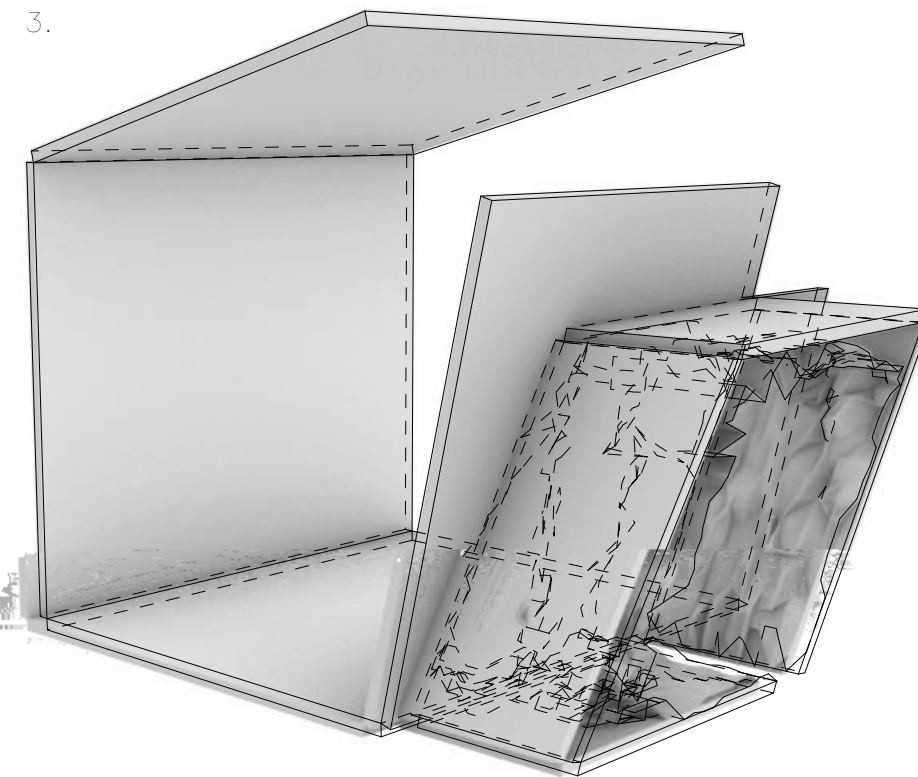
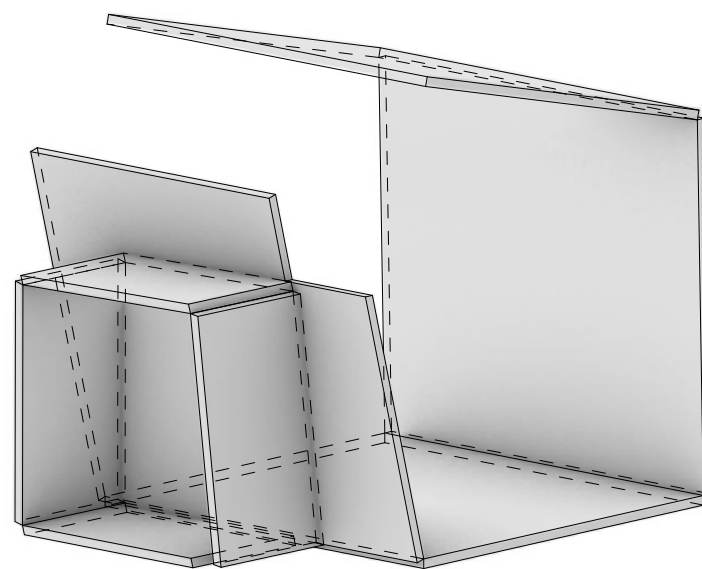
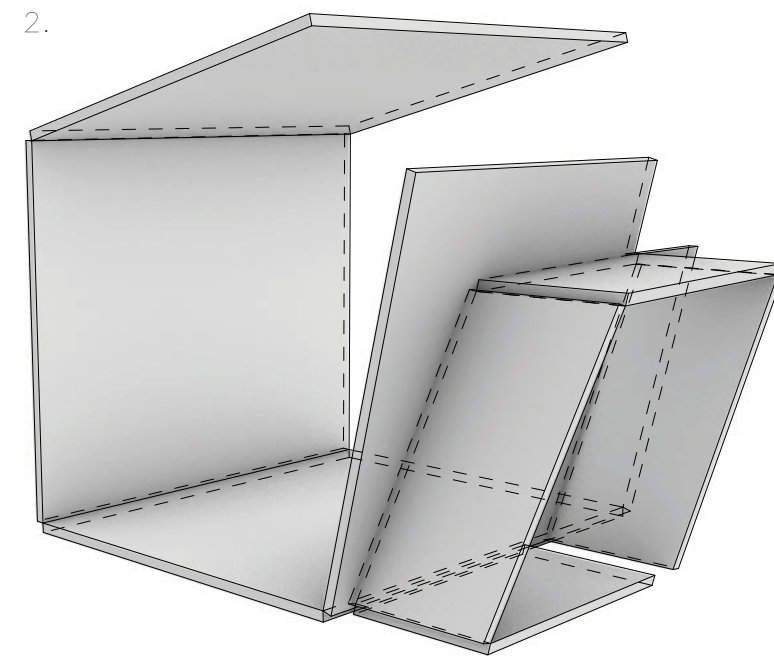
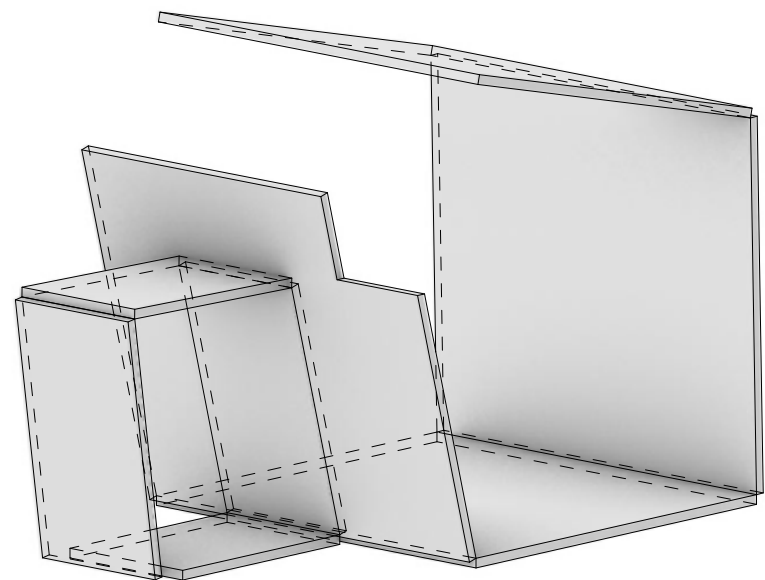
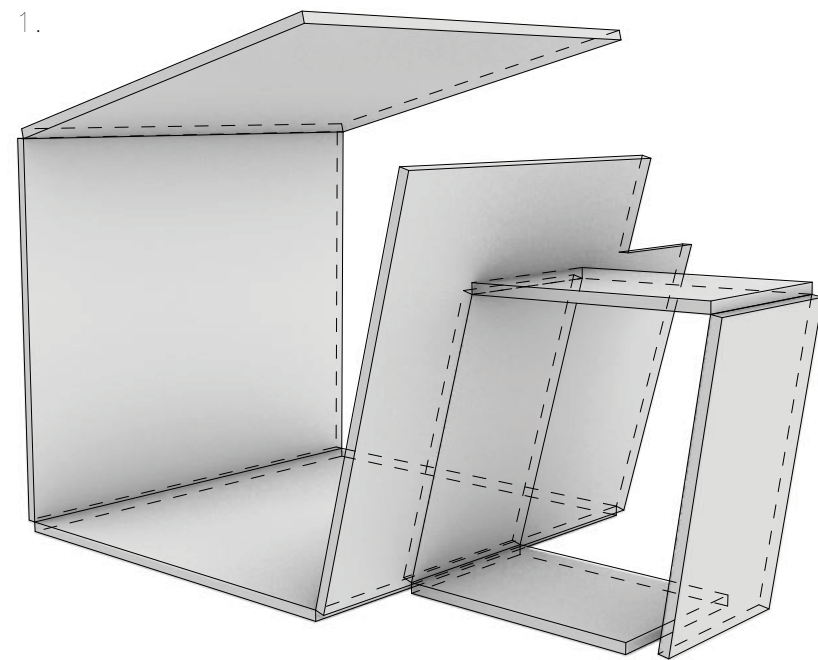
First the living space was isolated and modelled. Two separate polysurfaces were created then combined to form a more interesting and unique shape.



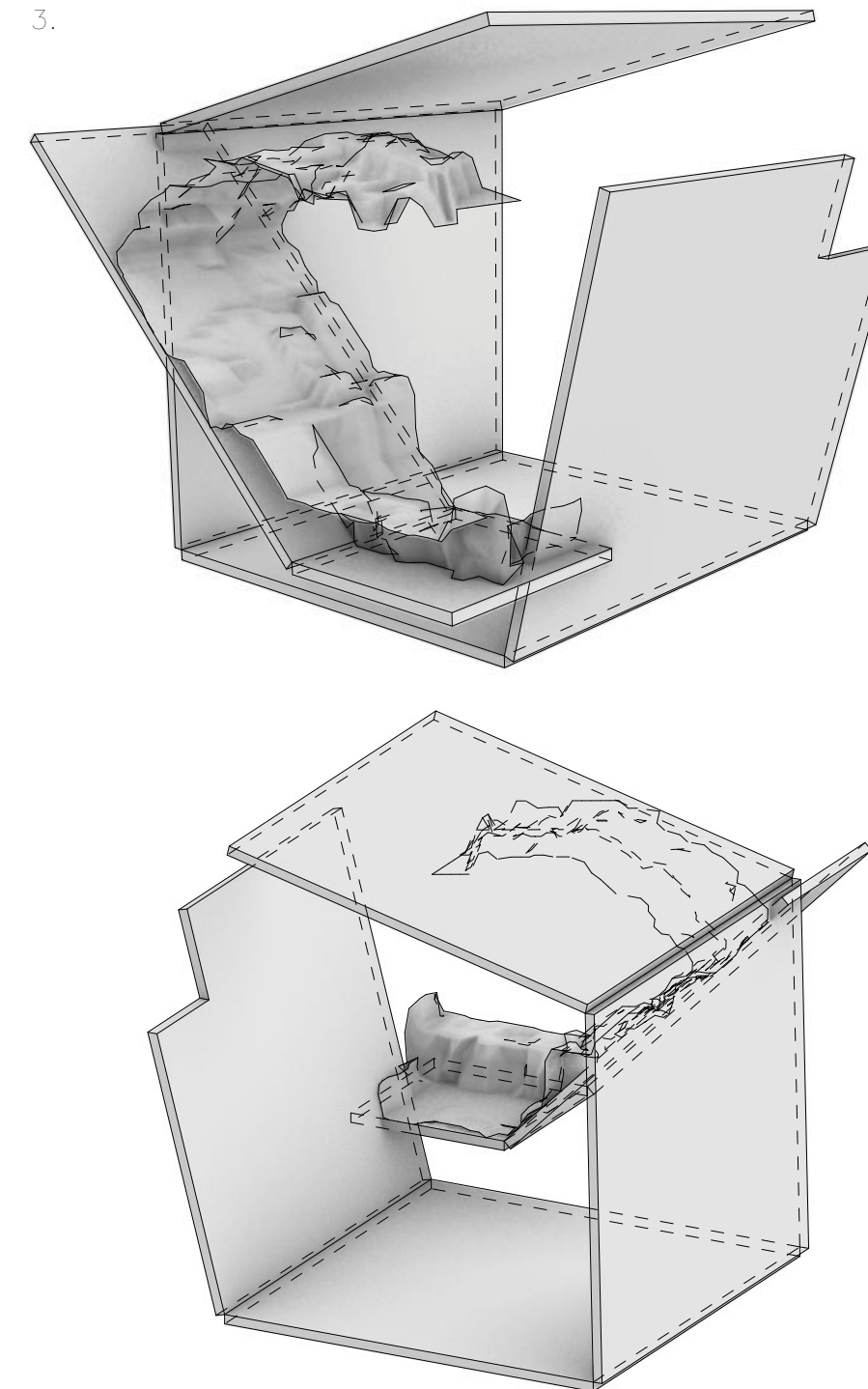
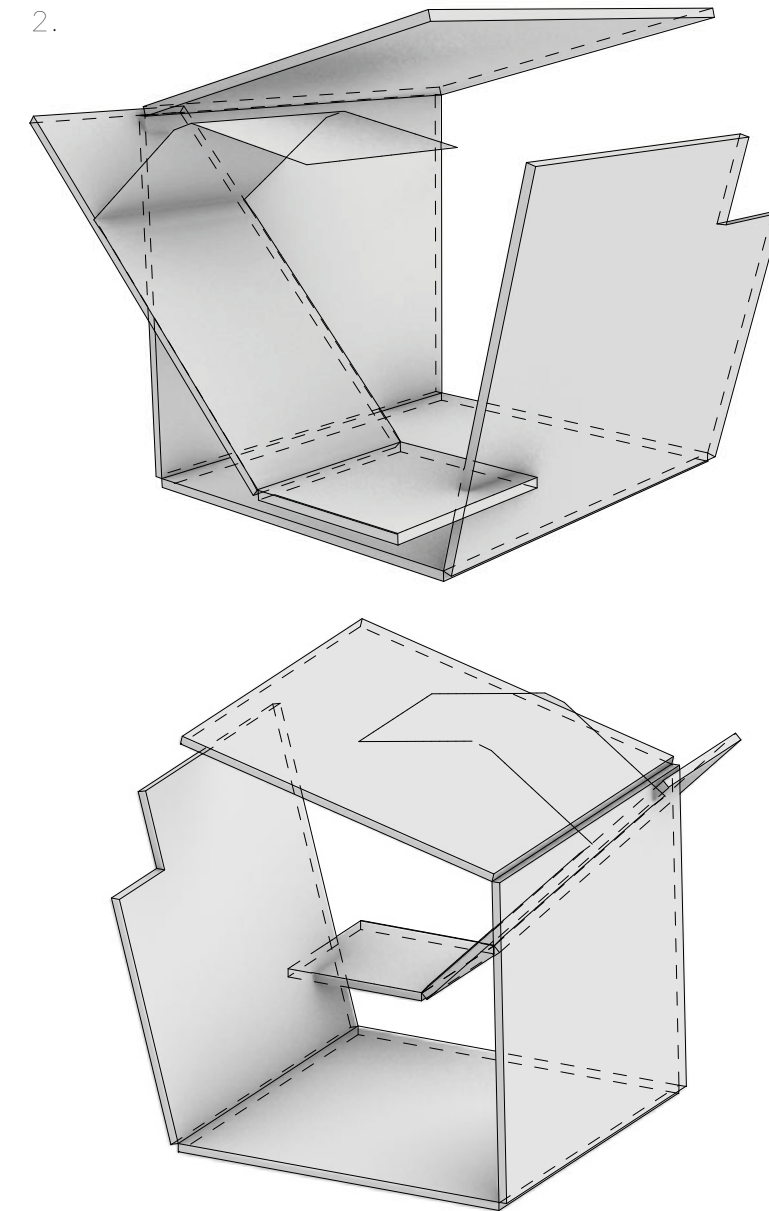
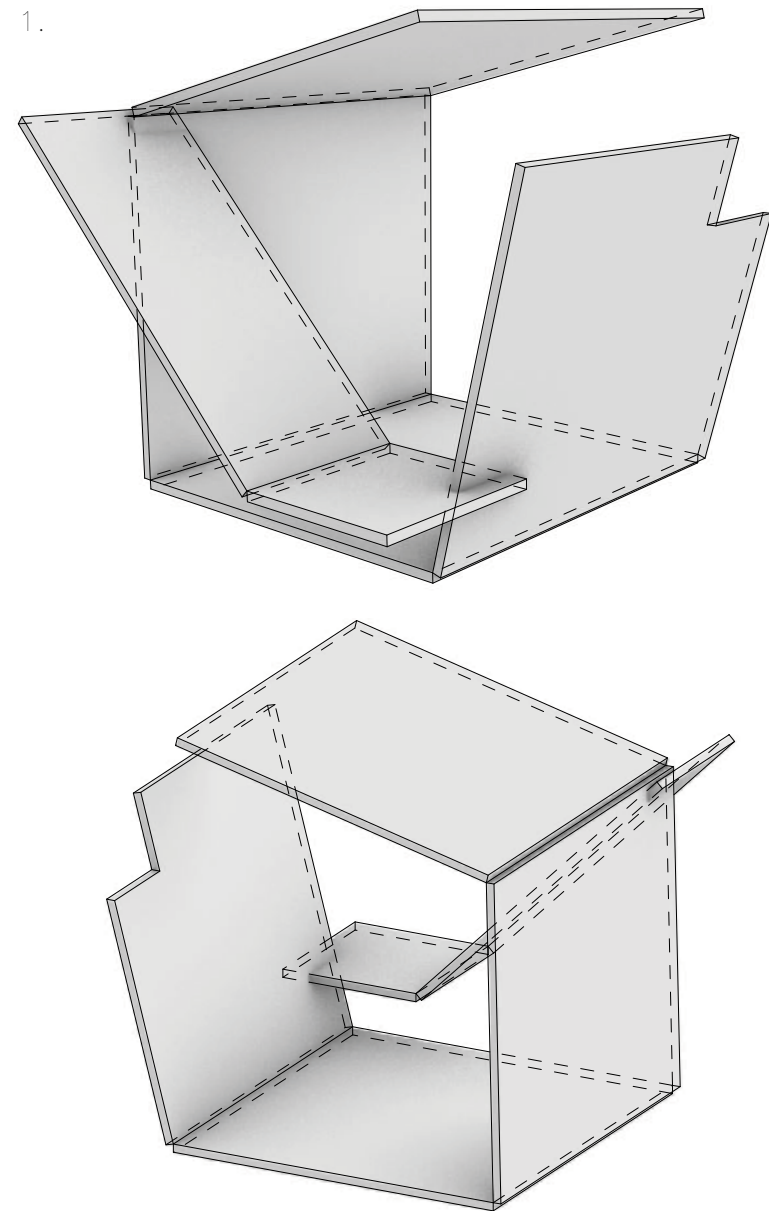
The second volume focused on was the bedroom. Using the same technique as the living room, two polysurfaces were combined into one organic form.





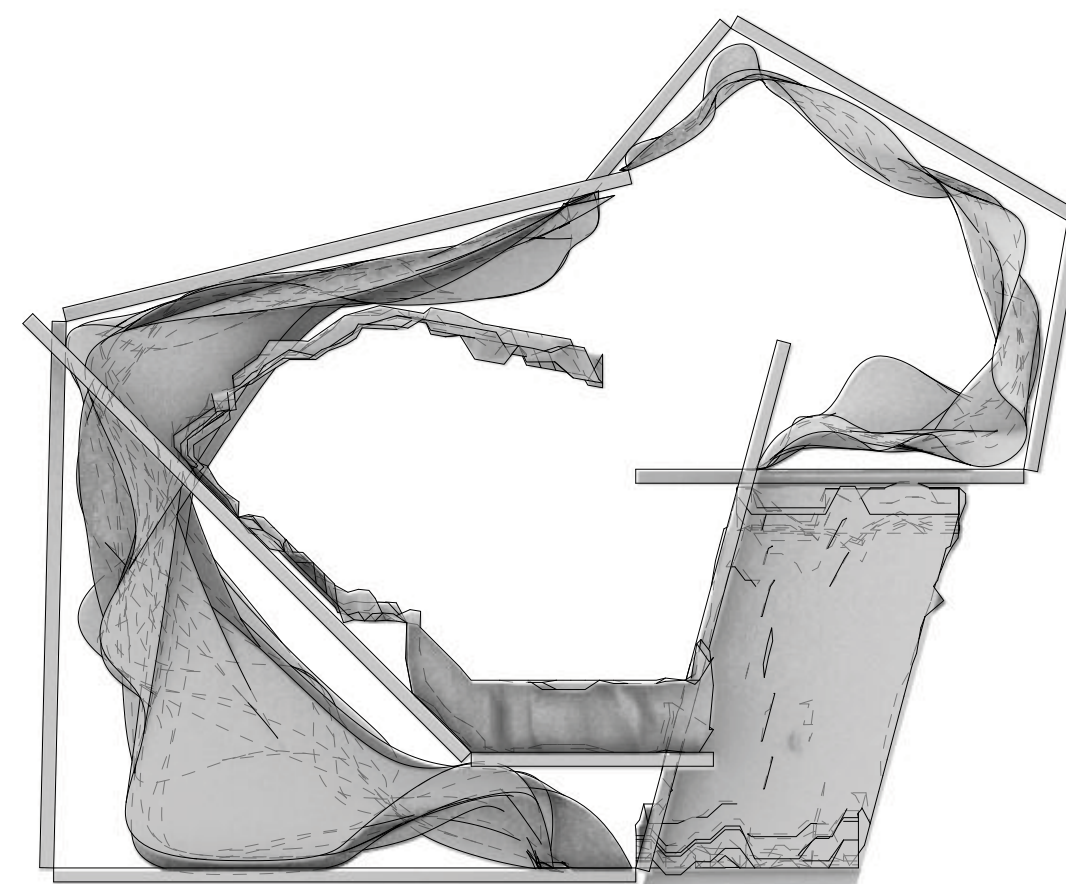
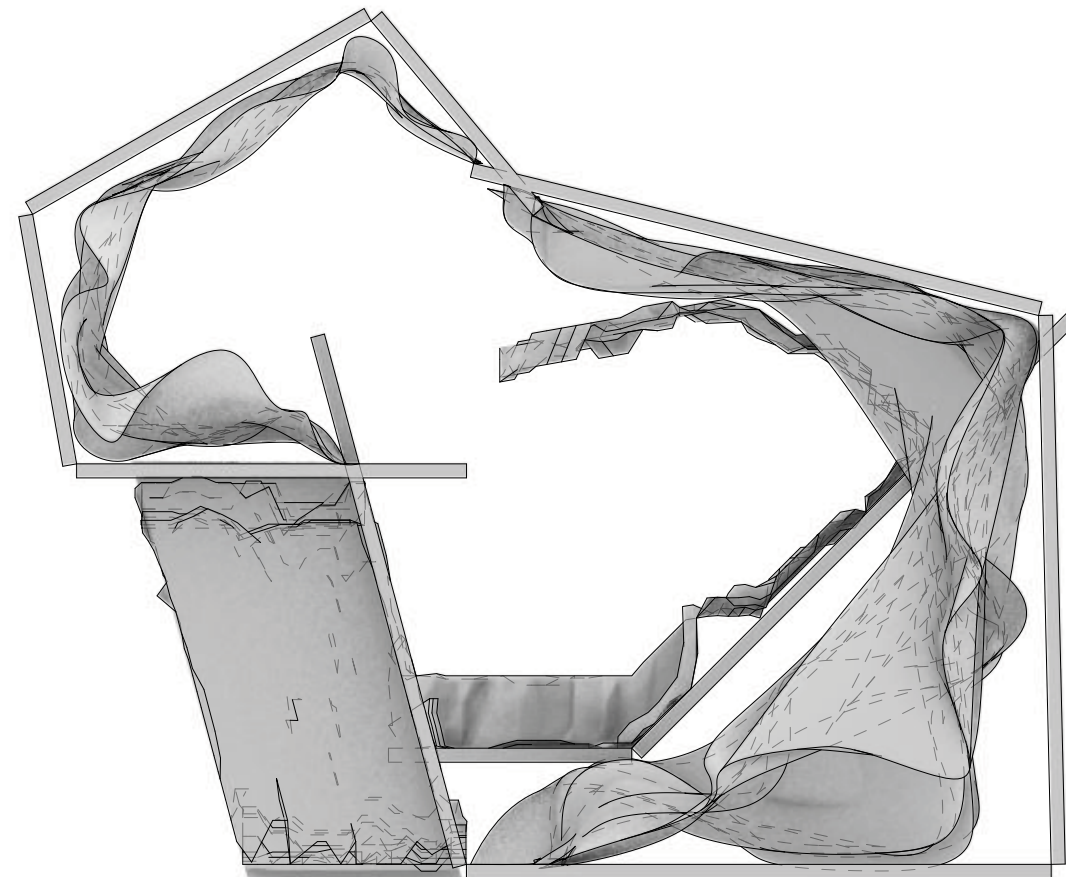
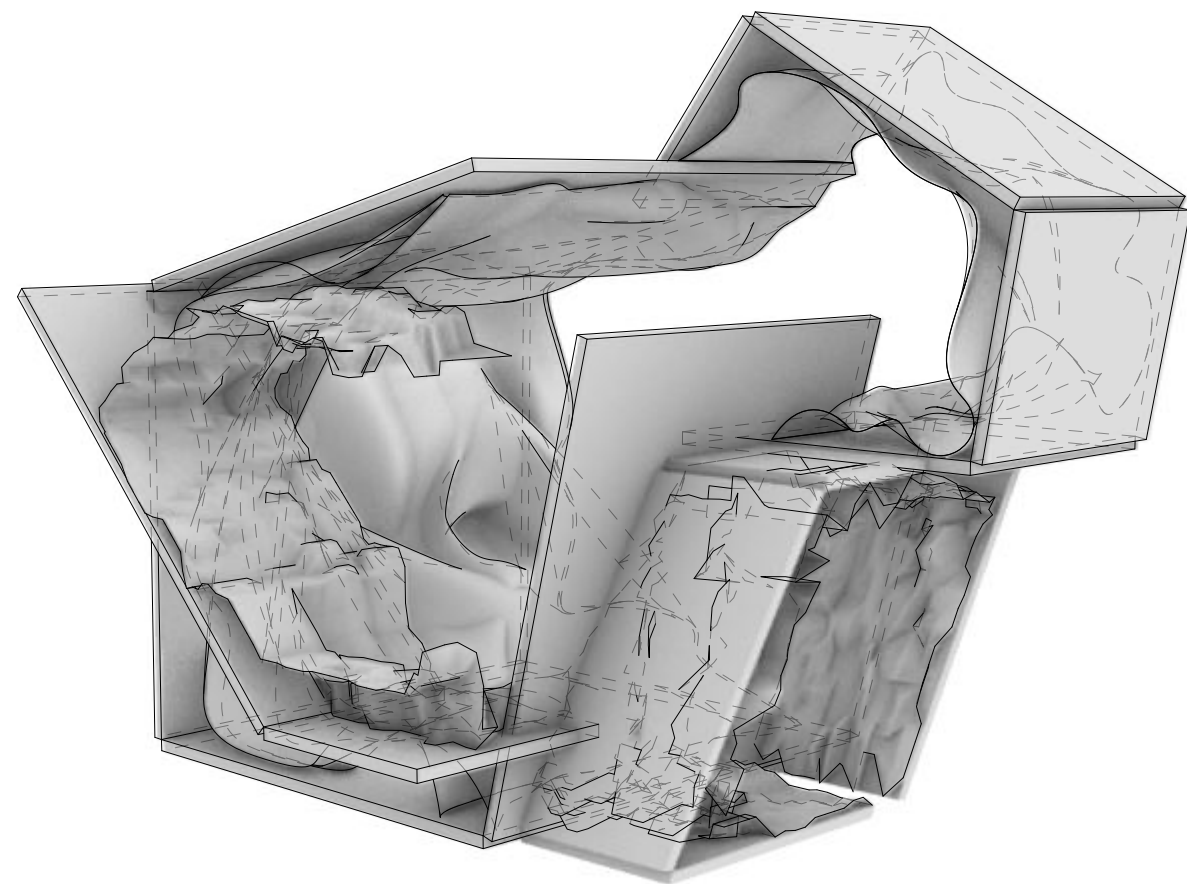
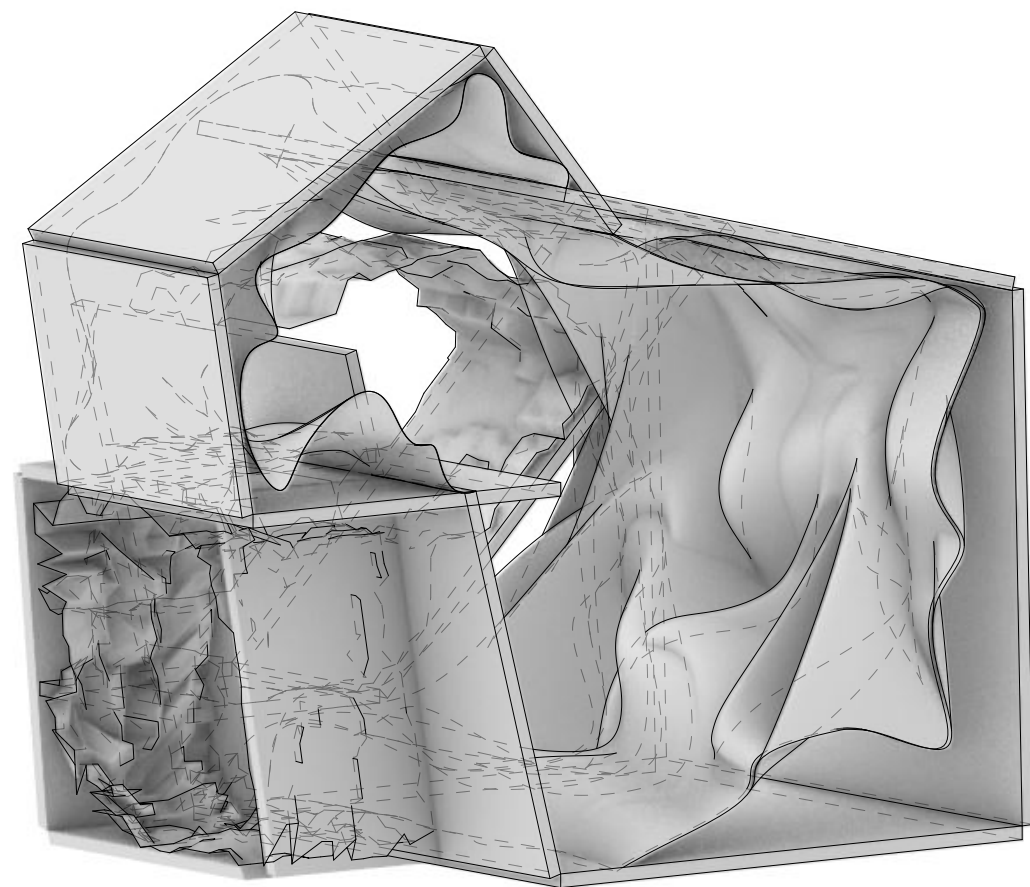


Third was the bathroom. The volume itself was altered slightly for more flexibility when it comes to both the layout of the bathroom, and the access into it. A polysurface was then added into the volume and manipulated into a geometric form.



The kitchen was the fourth and final volume to be modelled in this stage. The volumetric form of this varied somewhat from the physical model due to practicality and scale. Keeping the original volume shape would have rendered the space effectively unusable. A polysurface was added to the kitchen and manipulated in a similar way to the bathroom. This polysurface created the basis of the kitchen counter-top, shelving, and ceiling.





The four volumes were then reassembled to form the base design for the small home.



## Stage 3 : Threshold

Stage three designed the thresholds between spaces, focusing on the overall shape and tactile features of the transitions from one space to another. Each spatial threshold was isolated and looked at individually. The process began with analogue processing and model-making before moving to digital recreations of the forms created.



Through processing the photos of spaces created in the previous stage a few transitional spaces began to emerge. These were then focused on to develop further.

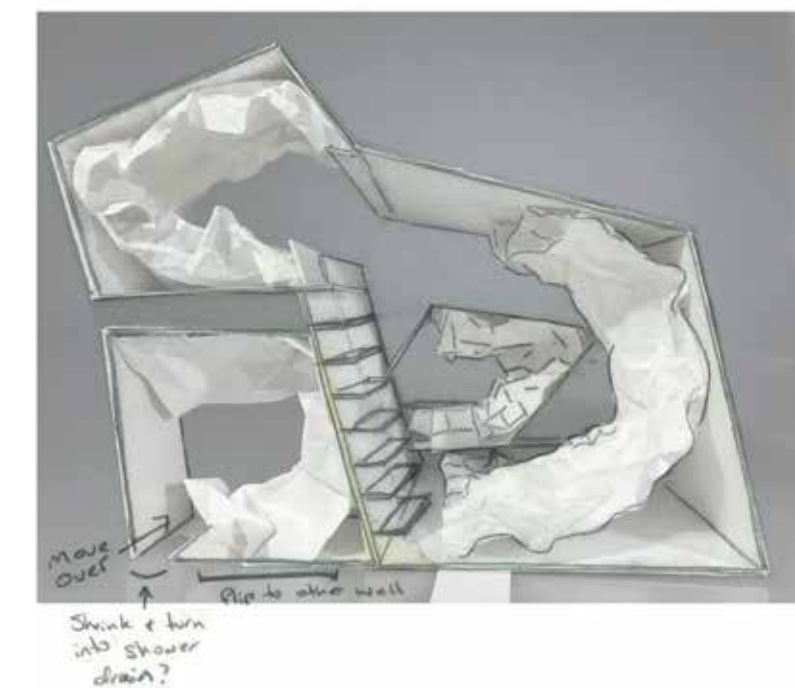
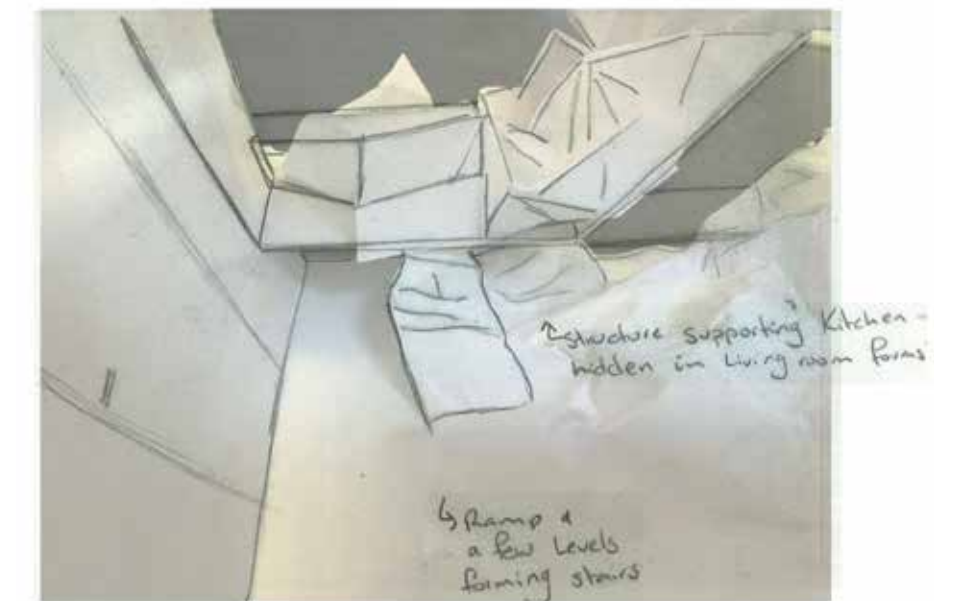
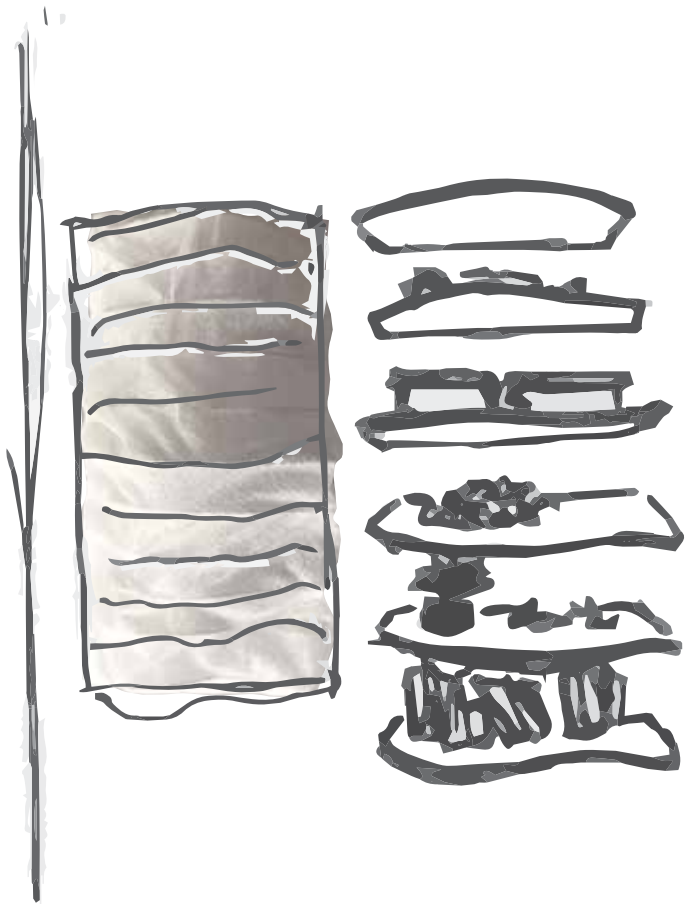
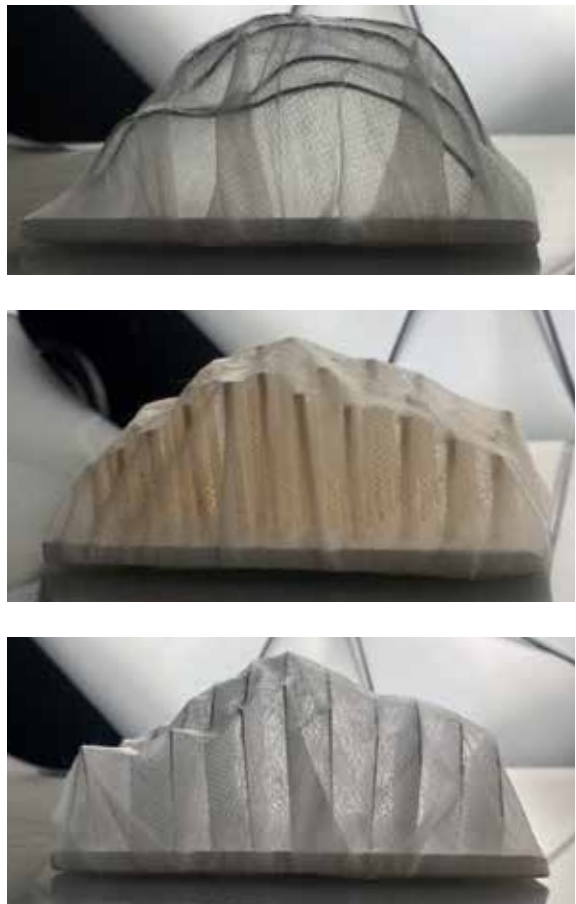


Figure.192



Figures.193-195: reference images from chapters 3 and 4 that inspired this step of the process

As with stage two of this process, inspiration was drawn from models made in chapter four. These models were used to inspire the structure and form of the threshold spaces.

The first of these was the access to the bedroom. Using a ladder that doubled as shelving would both save space and make use of the angle of the wall. This was influenced by previous models and the form of the body.

Initial scale and dimensions were generated from existing physical models so that proportions would be correct.

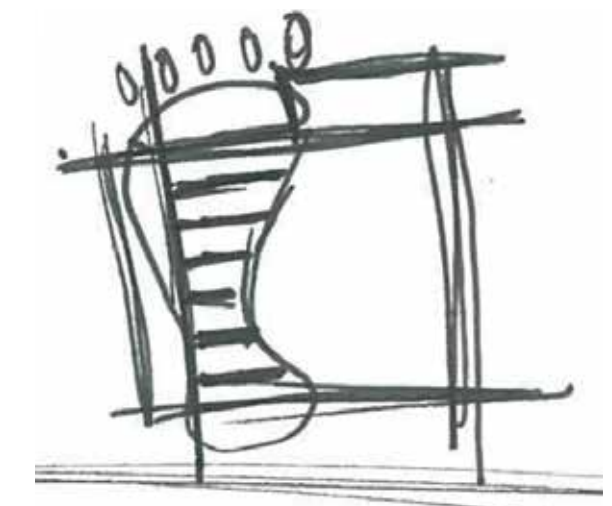
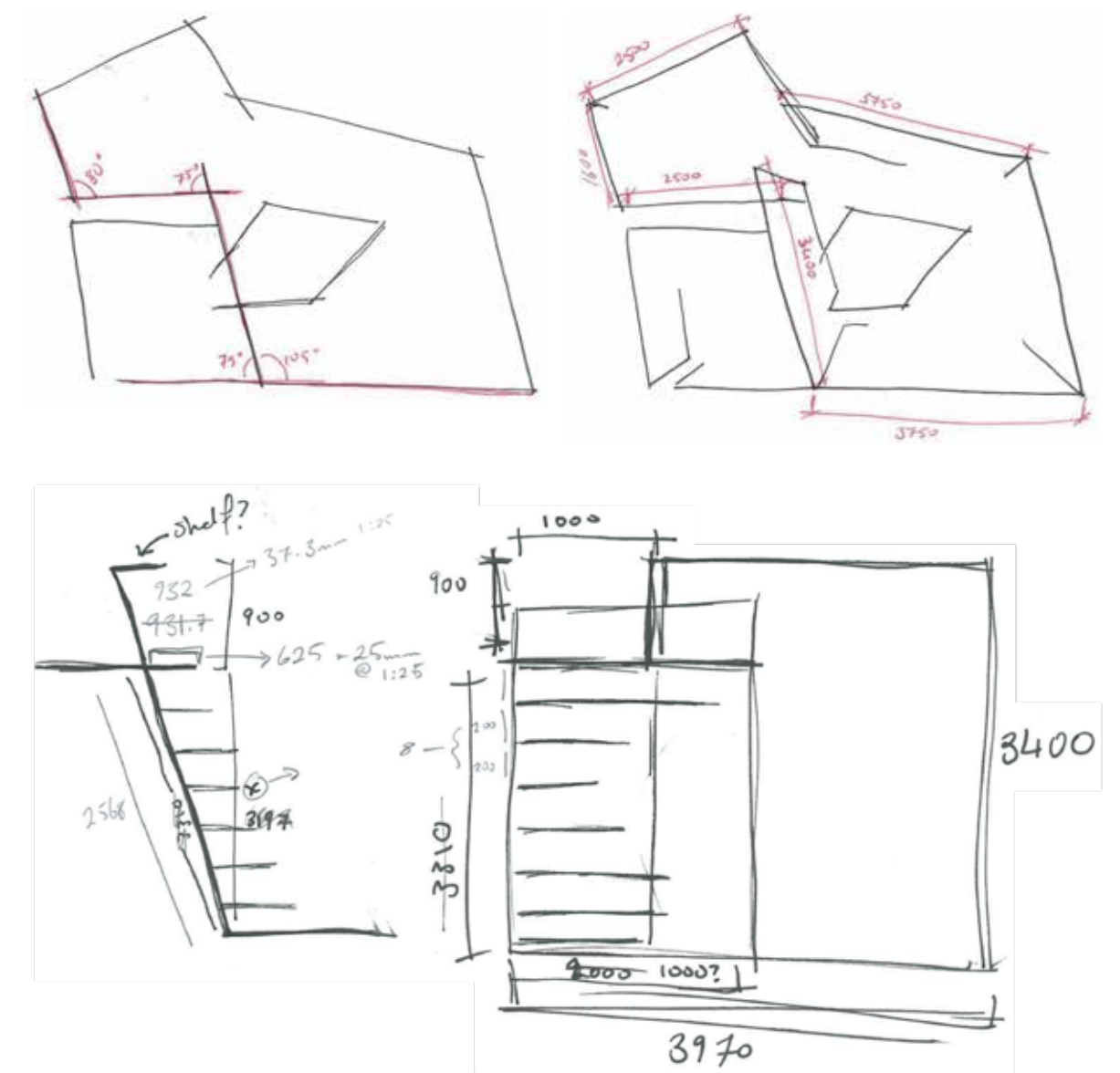
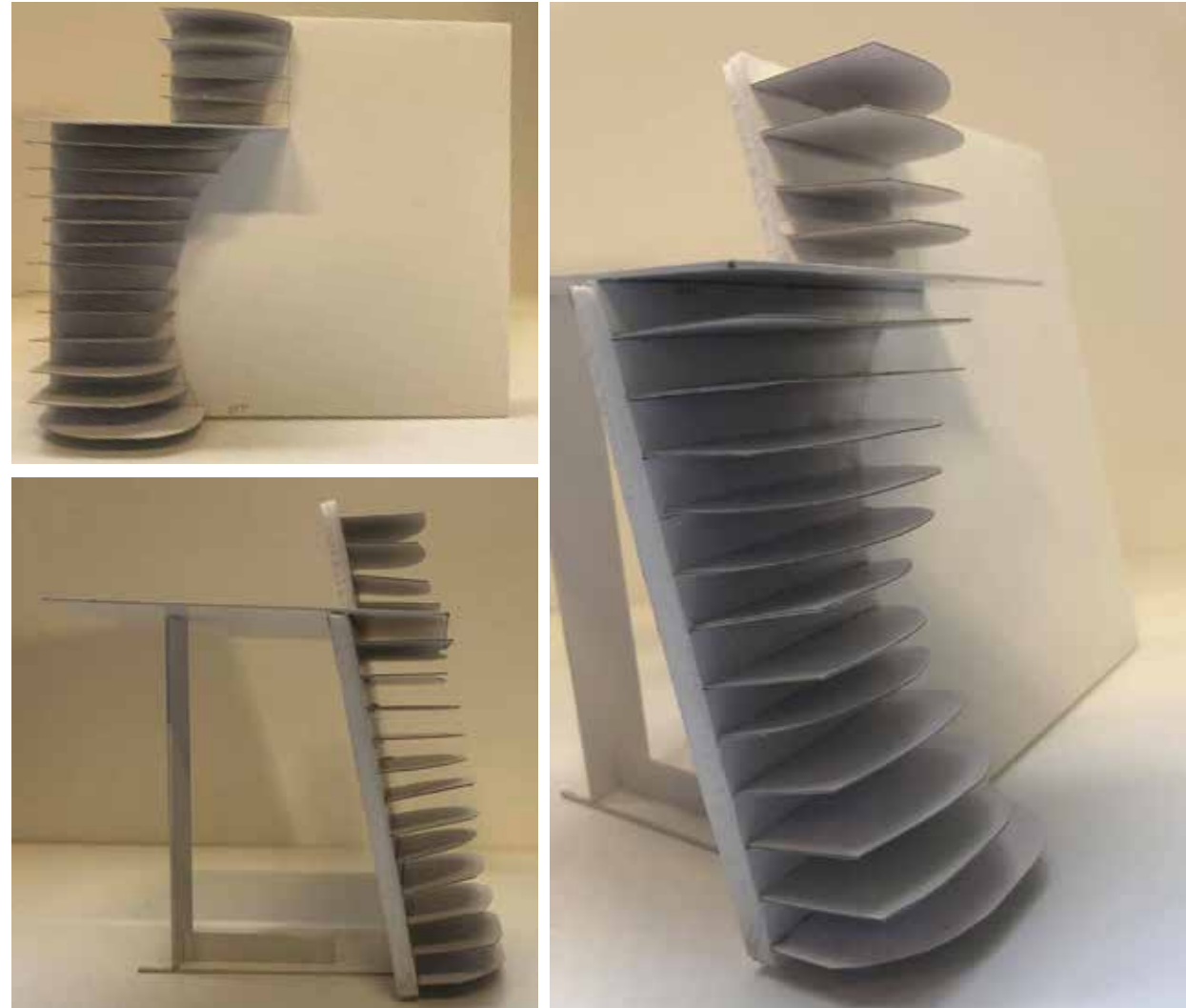


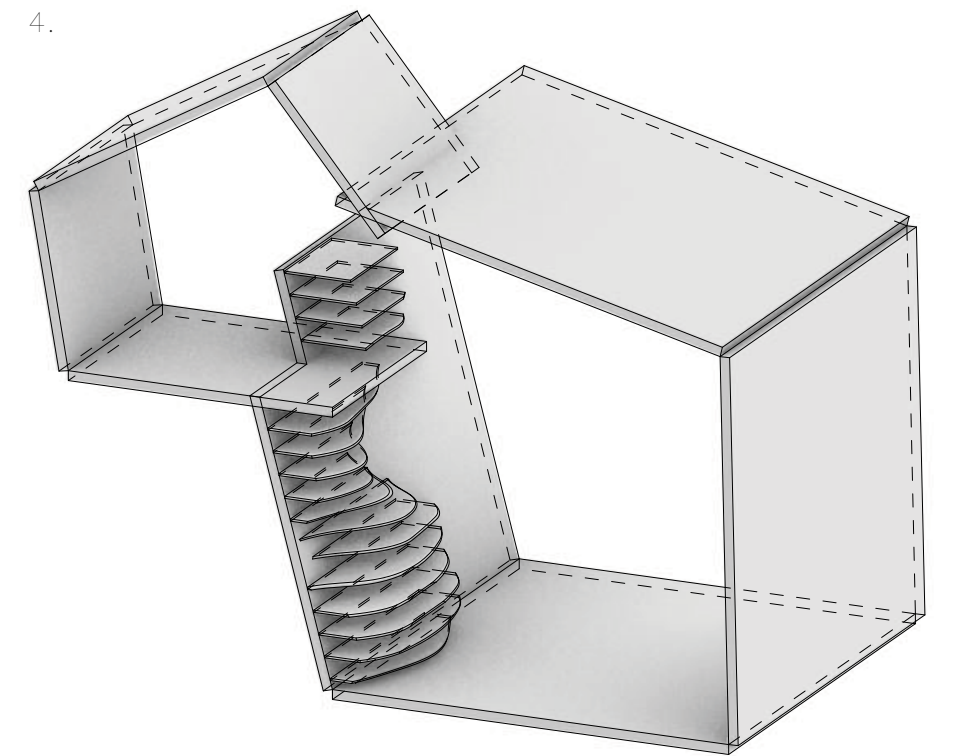
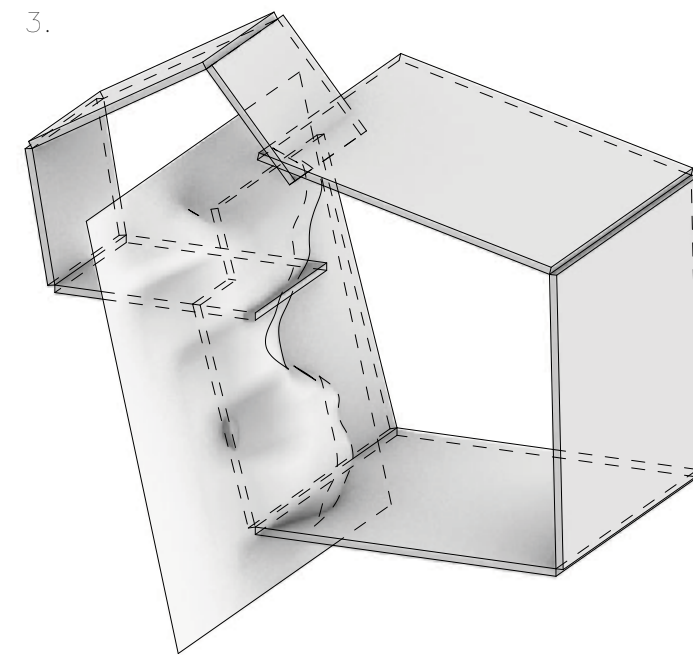
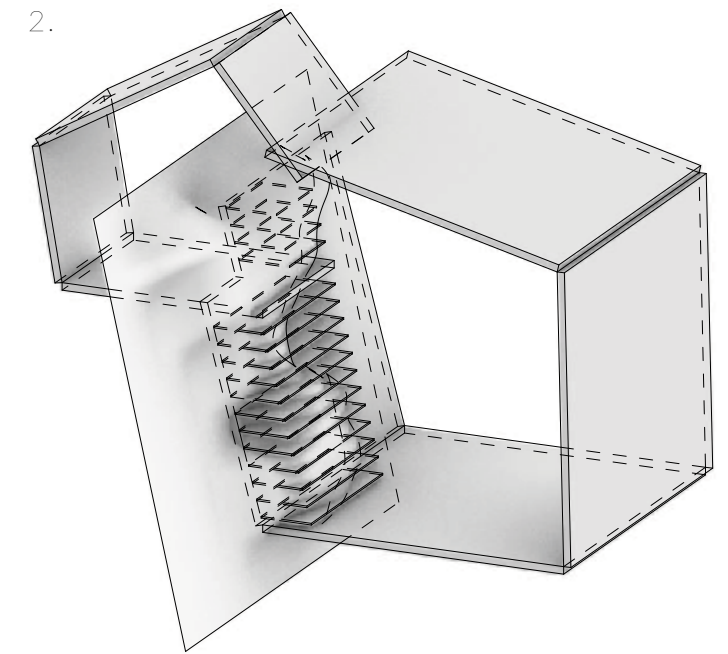
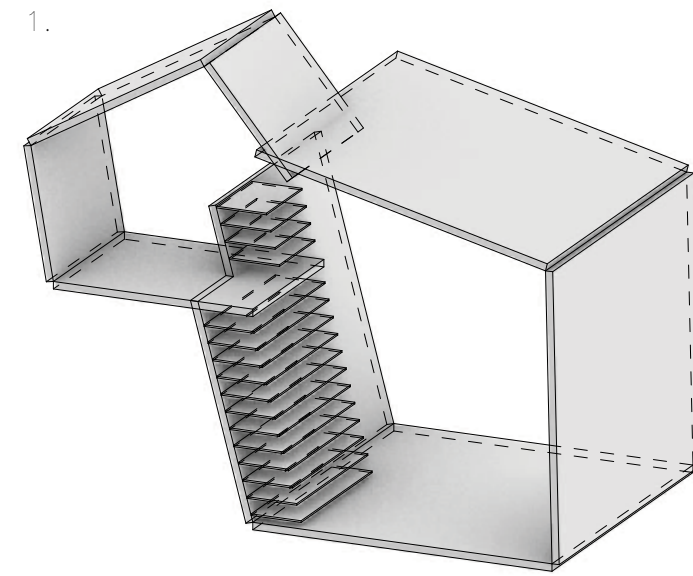
Figure.196



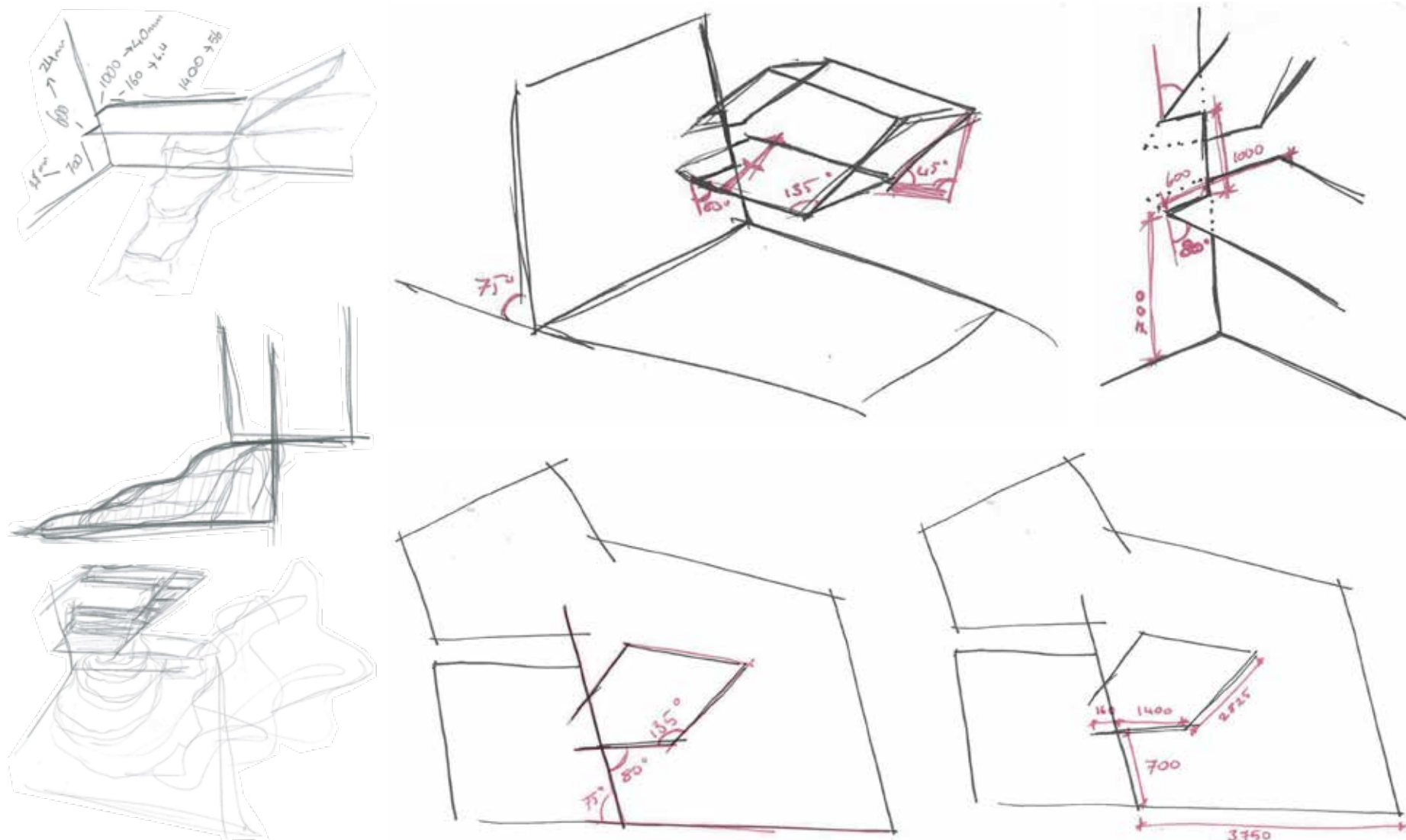




Once the base form was created to scale, the ladder access to the bedroom could be created. This was again done through semi-intuitive physical modelling. The physical model then informed the digital.



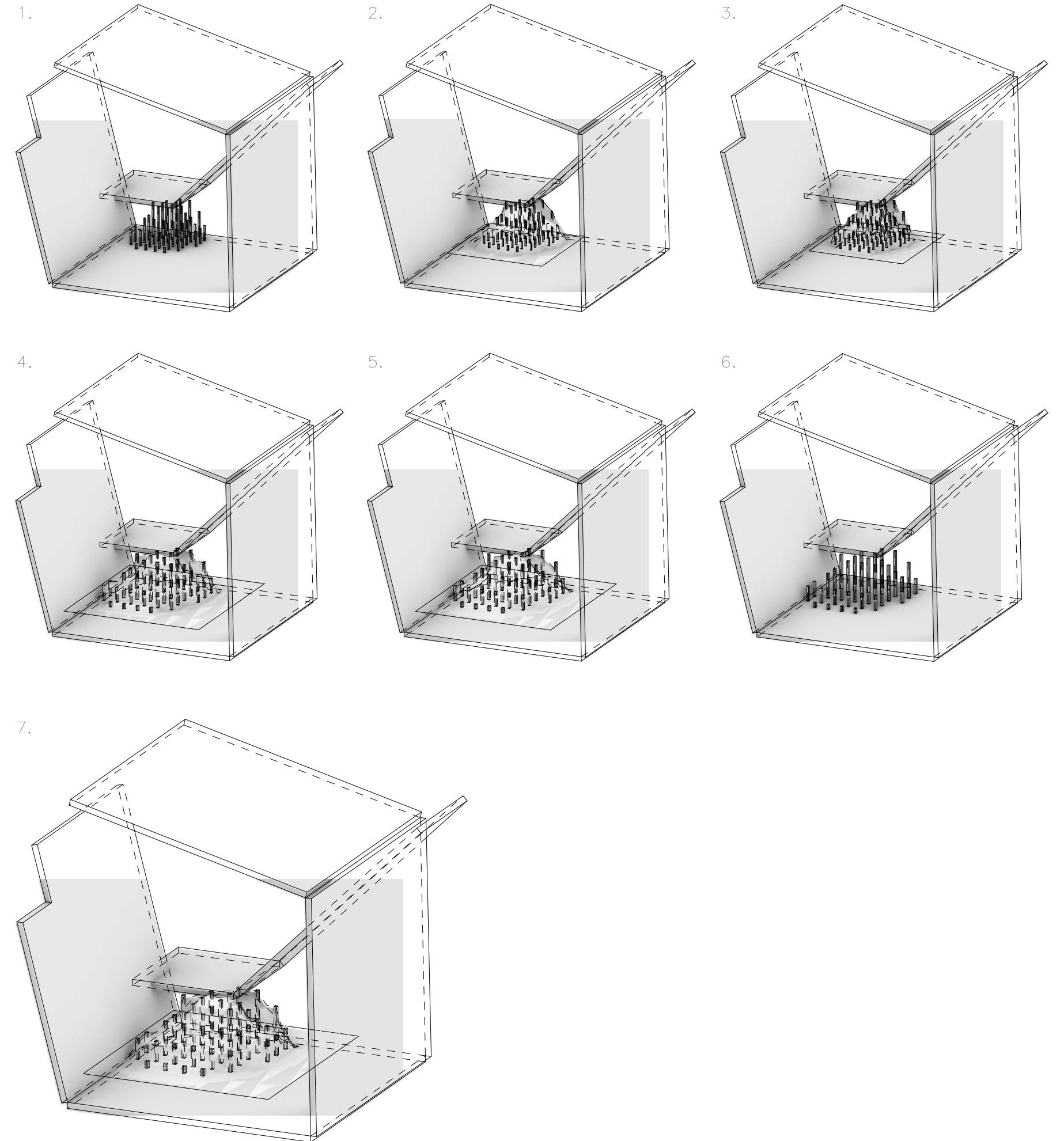


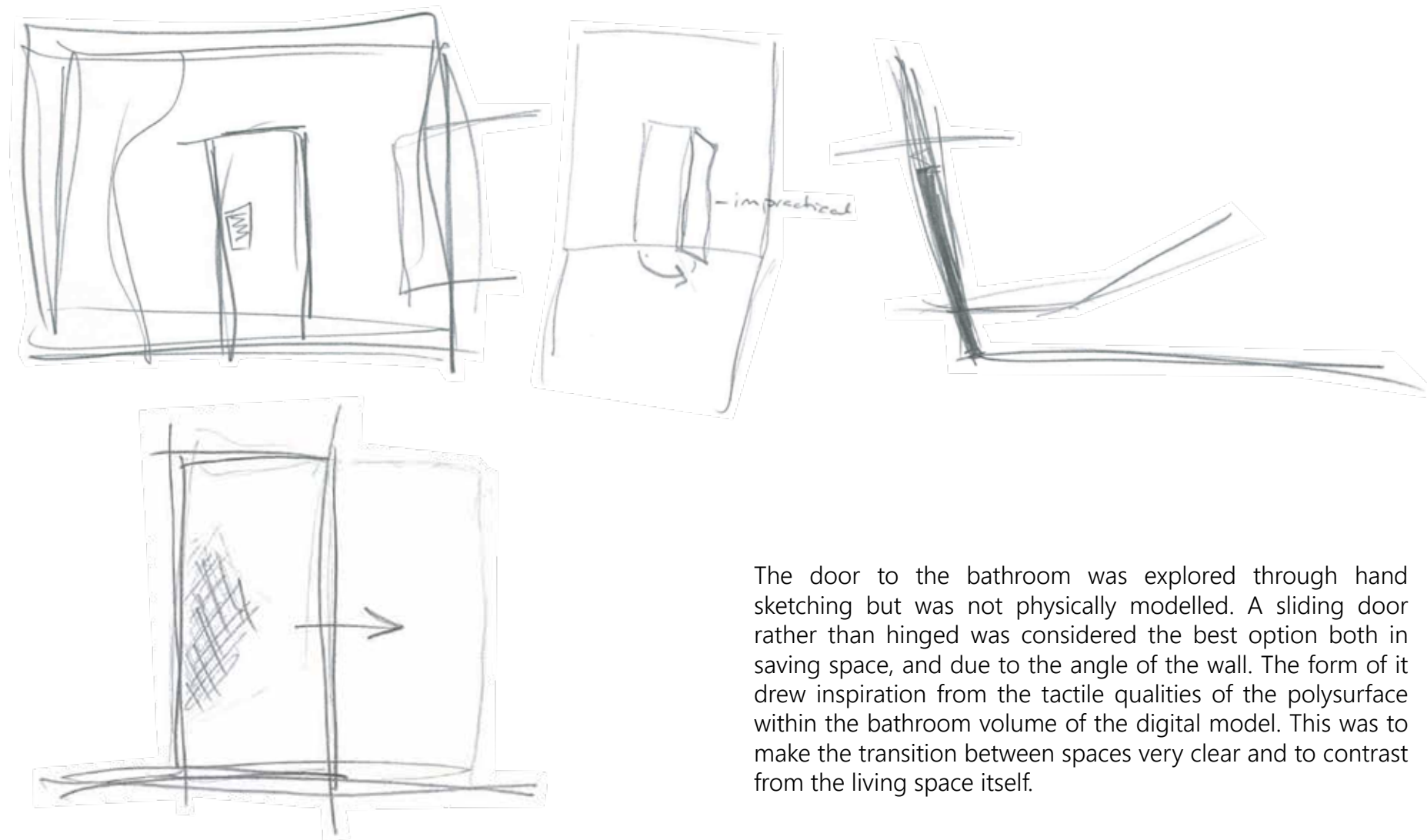


As the kitchen volume is at a higher level than the living area floor, a ramp or stairs were required. The form of the model from the previous stage was taken as inspiration, as well as a previous physical model.

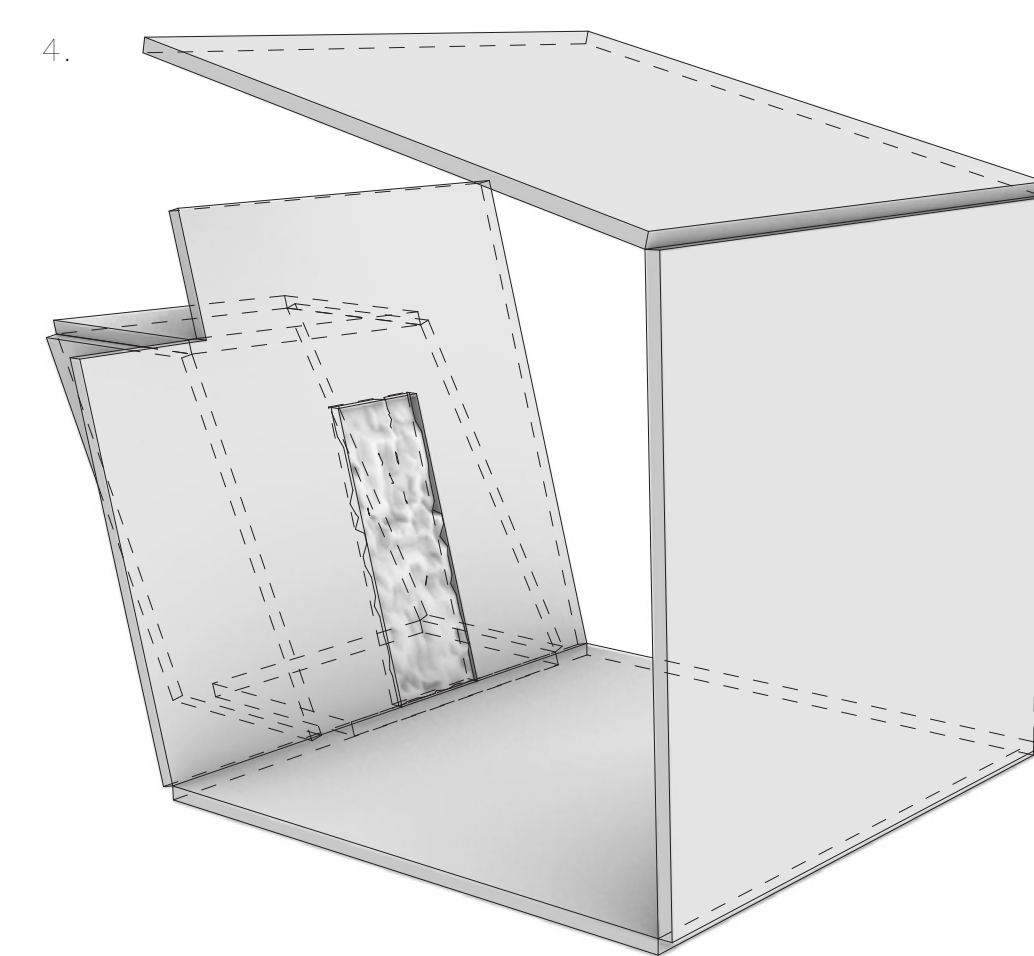
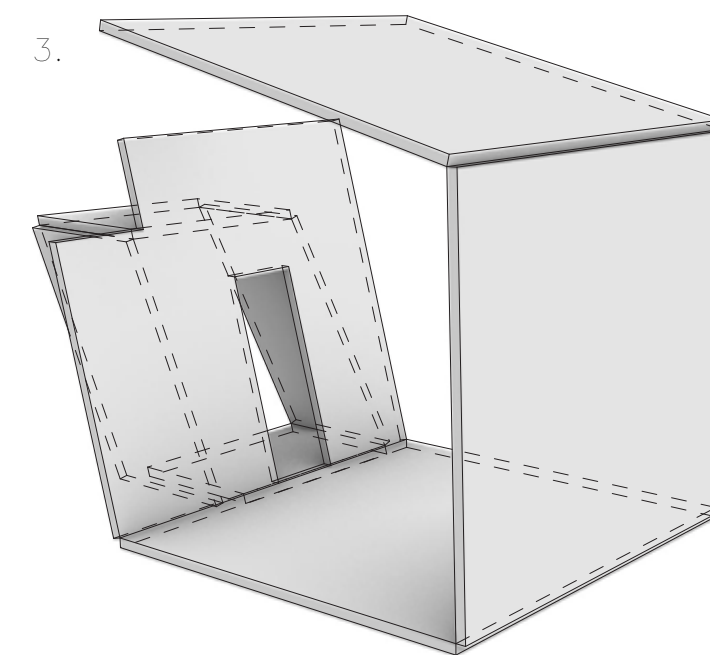
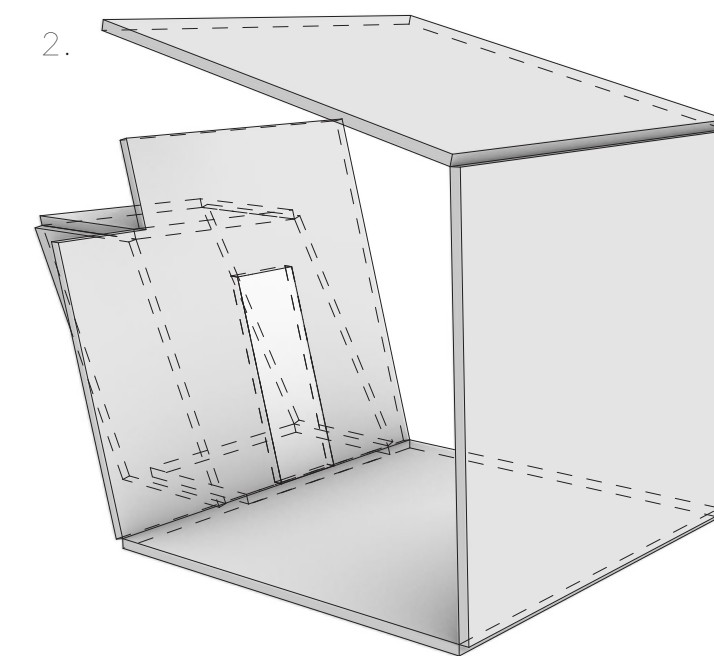
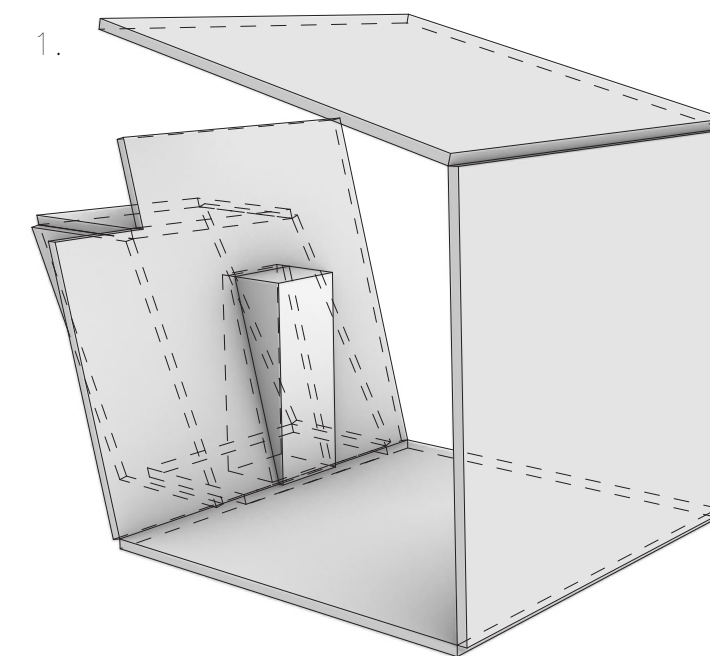


A semi-intuitive physical model was created before being digitised.

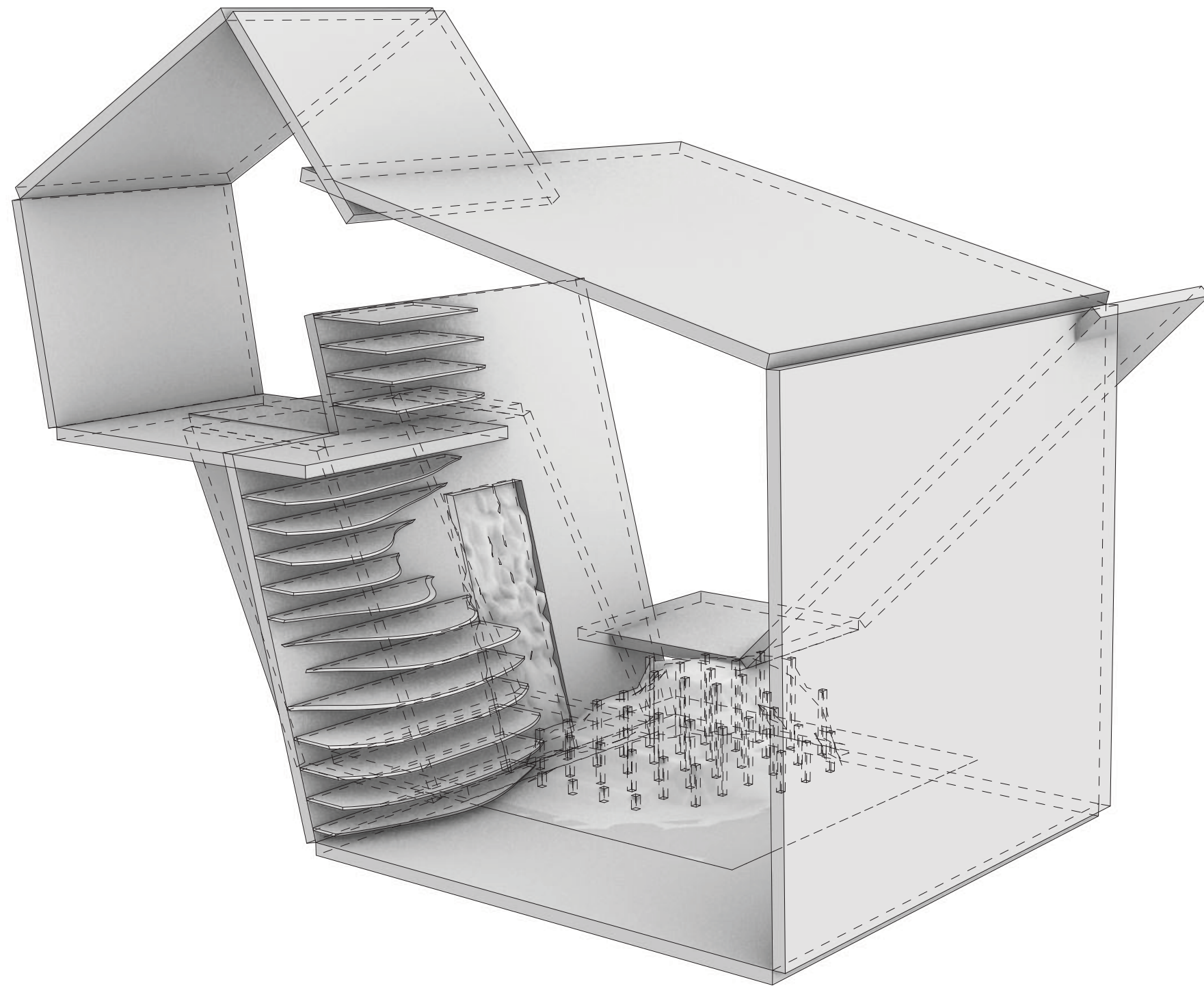




The door to the bathroom was explored through hand sketching but was not physically modelled. A sliding door rather than hinged was considered the best option both in saving space, and due to the angle of the wall. The form of it drew inspiration from the tactile qualities of the polysurface within the bathroom volume of the digital model. This was to make the transition between spaces very clear and to contrast from the living space itself.







All access-ways and transitional spaces shown together.

## Stage4:Oversaturation

Stage four involved the addition of lighting and colour. Once all spaces and thresholds were conceptualised and modelled, the lighting within the space and the colours used in both lighting and surface materials were explored. This was done with the intention of reinforcing and accentuating desired emotive responses and tactile qualities within each zone of the home.

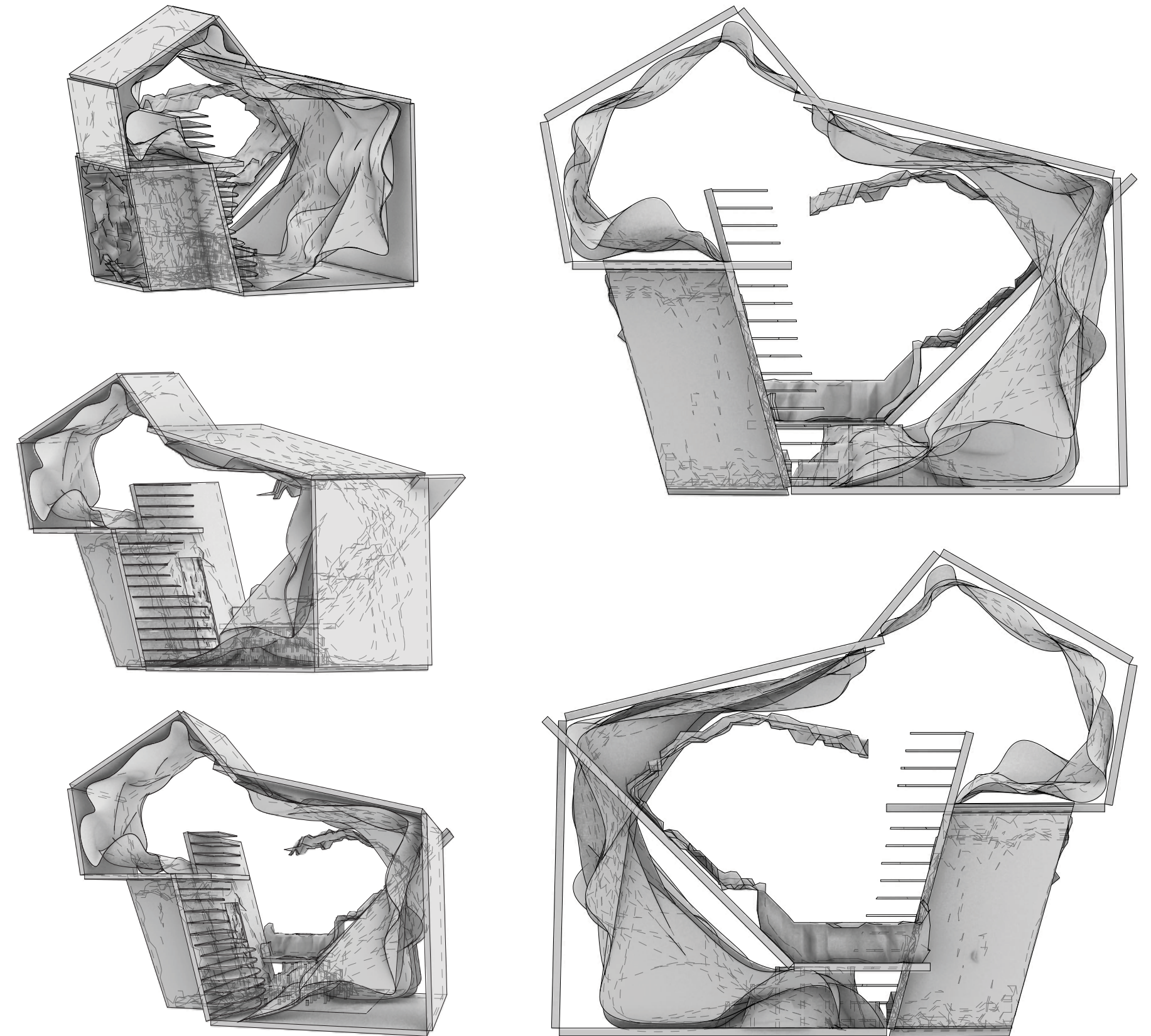
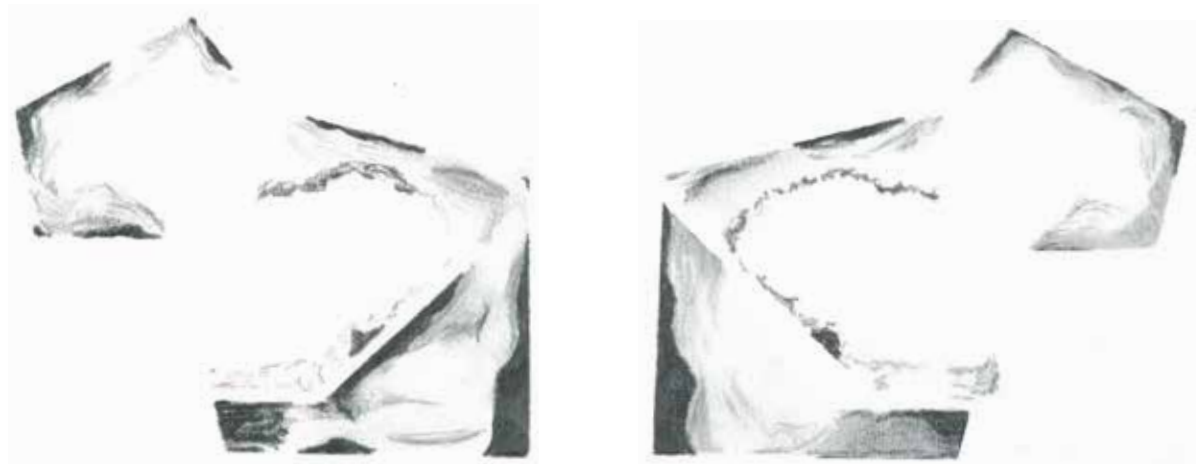


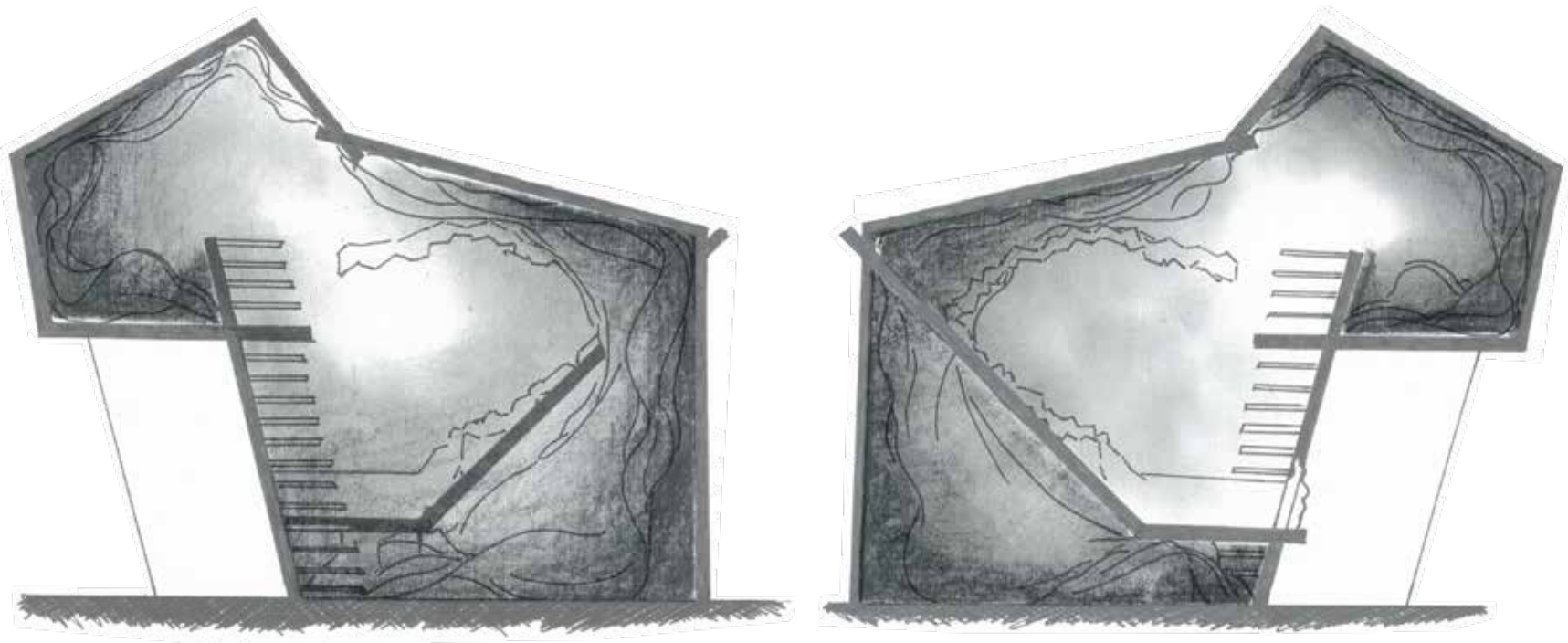
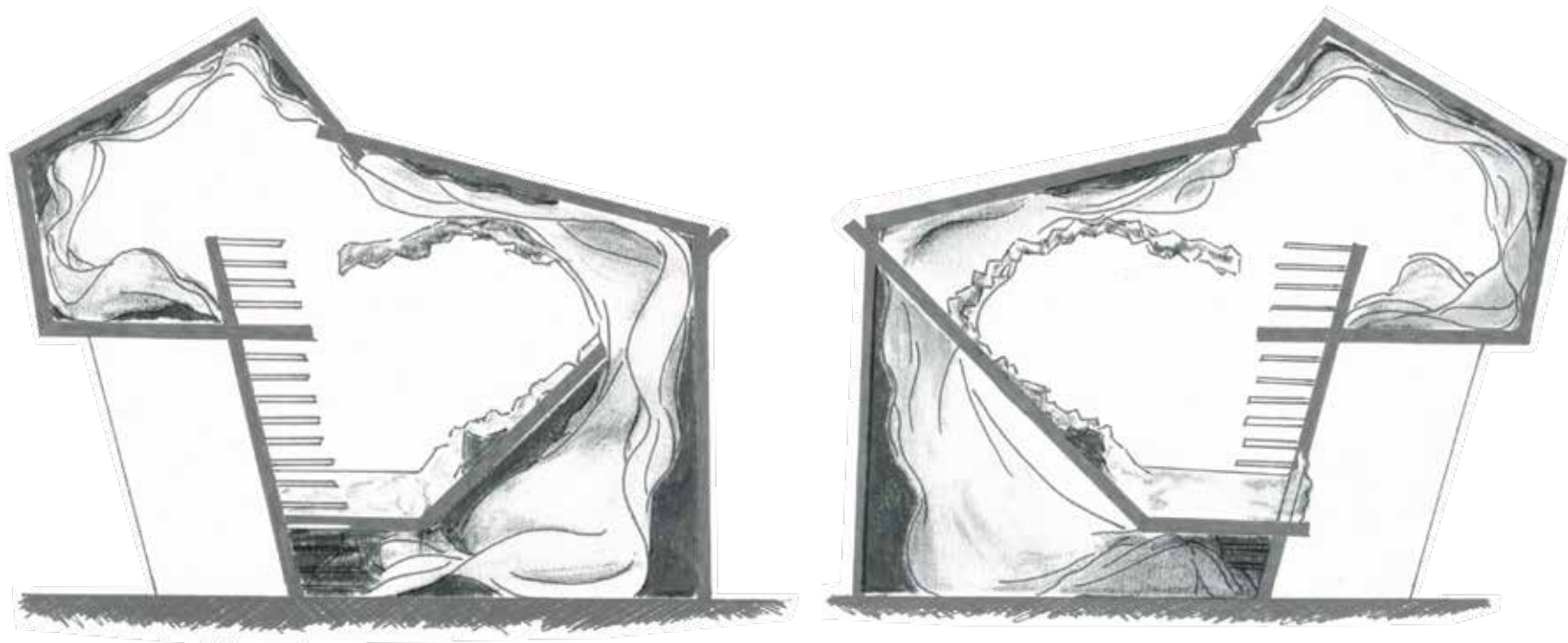
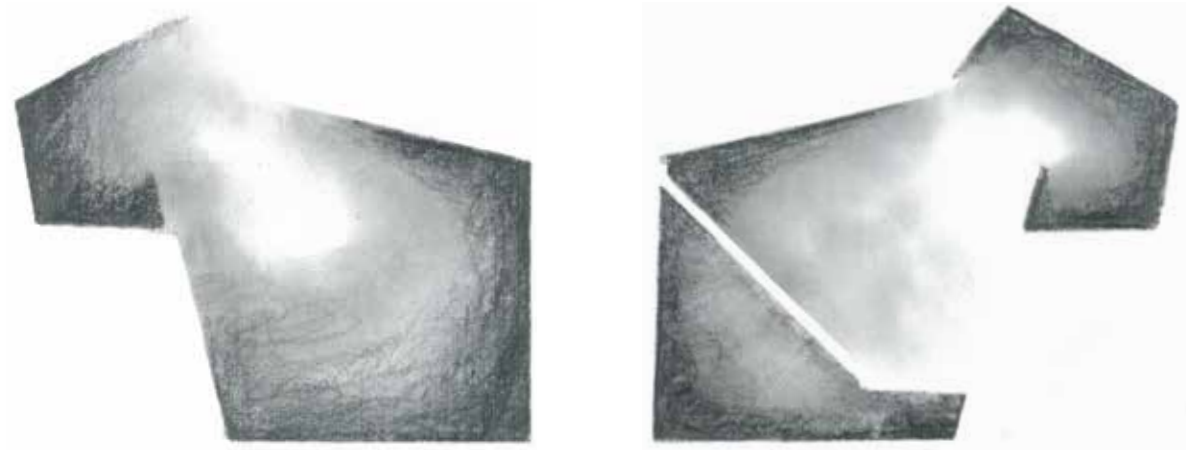
Figure.205



light

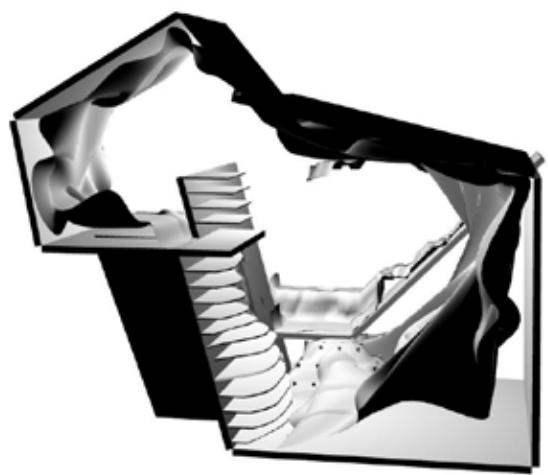
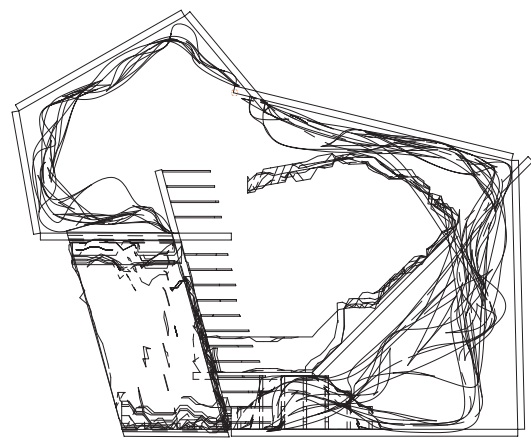
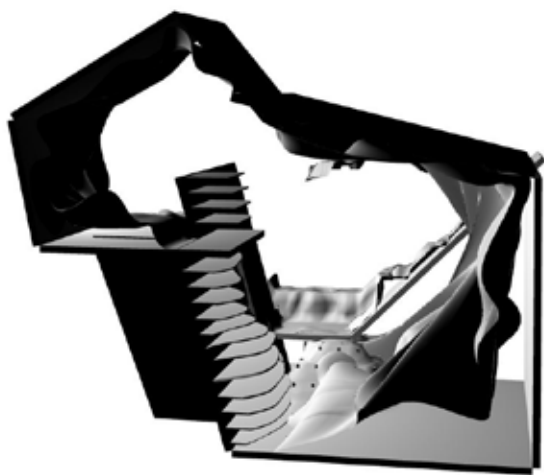
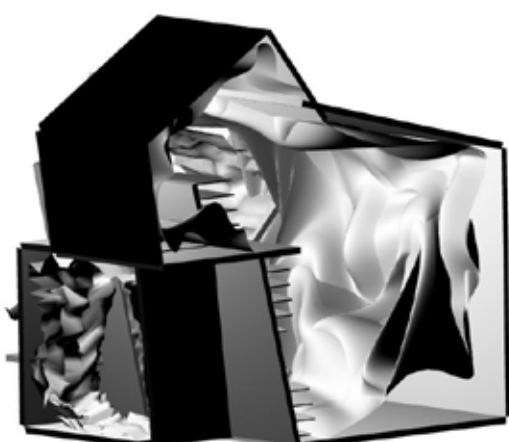
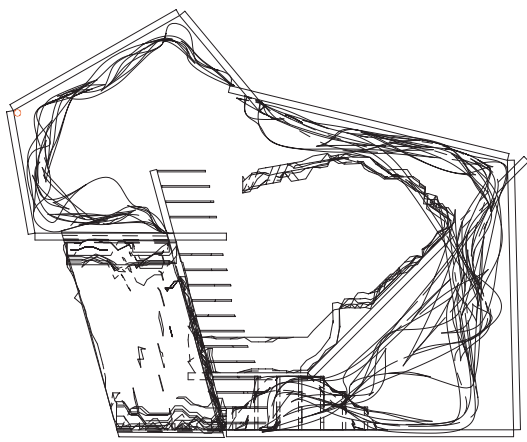
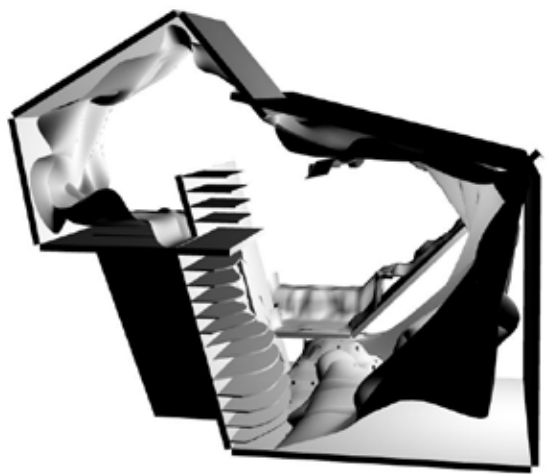
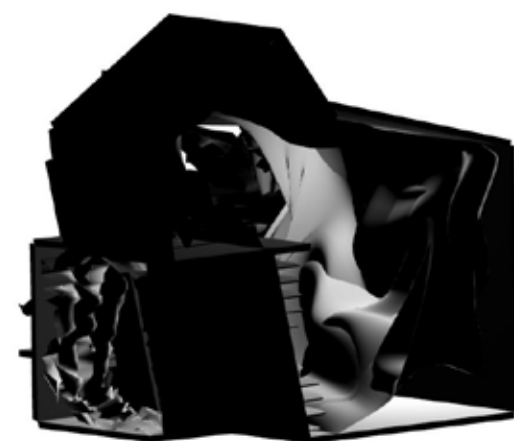
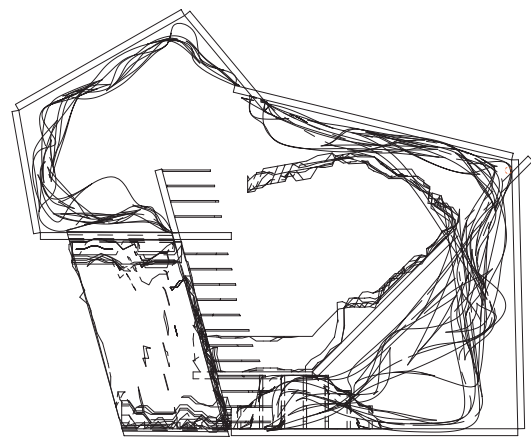
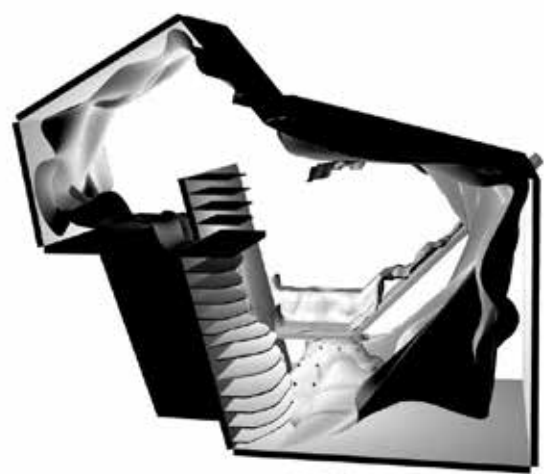
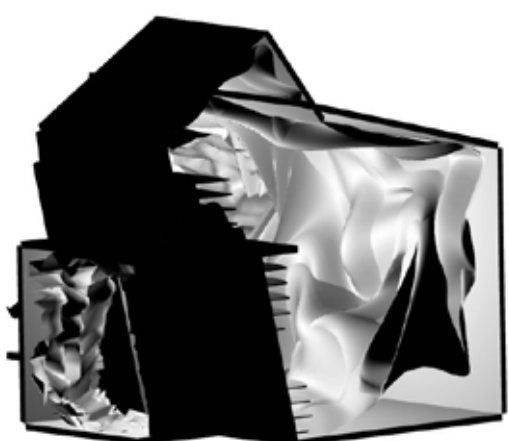
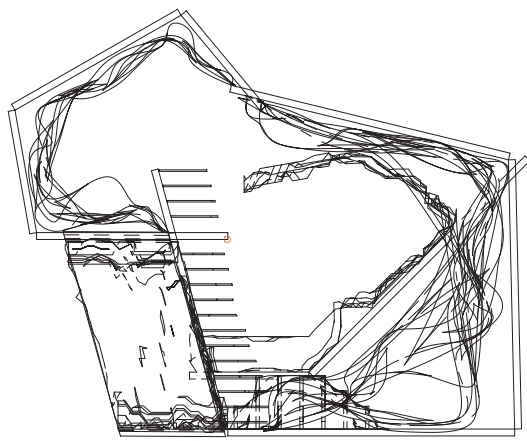
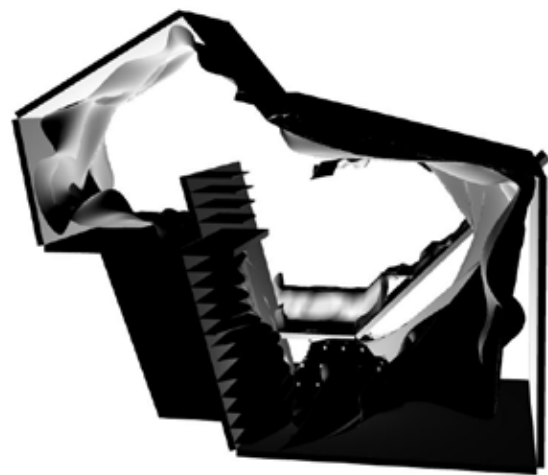
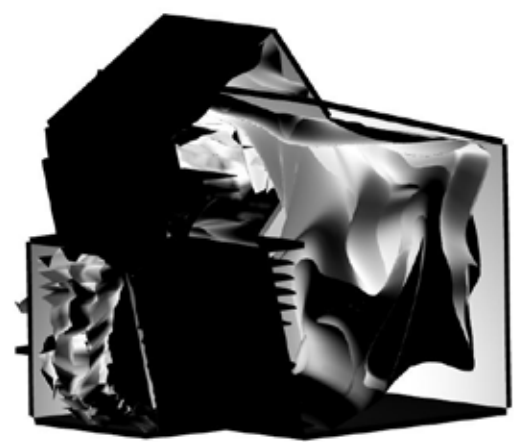
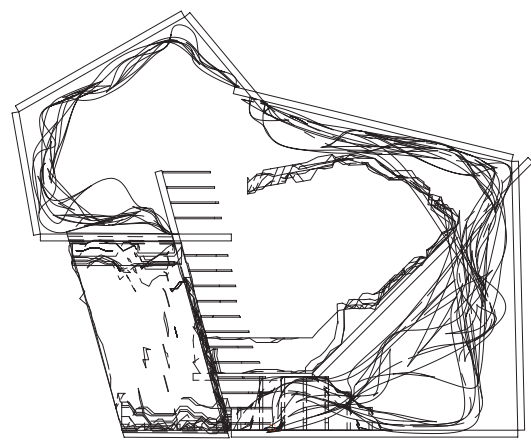
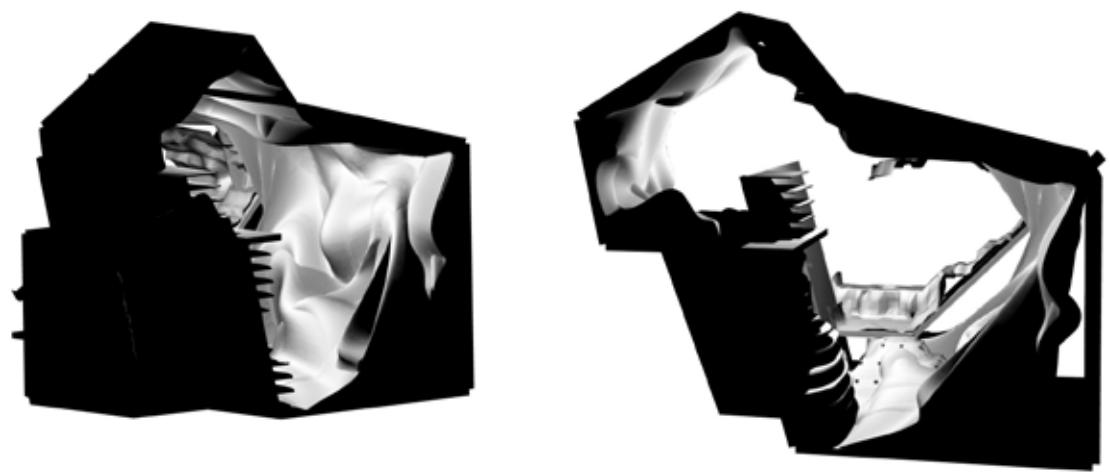


A charcoal and graphite study of the digital model was done as a starting point for lighting qualities.

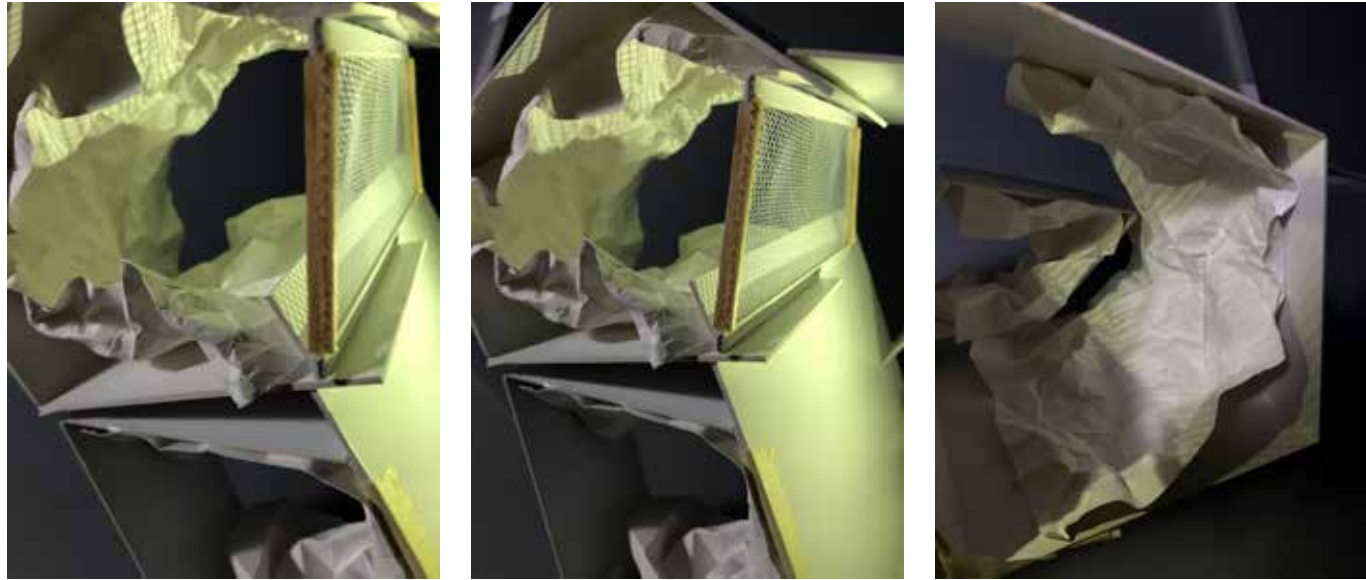




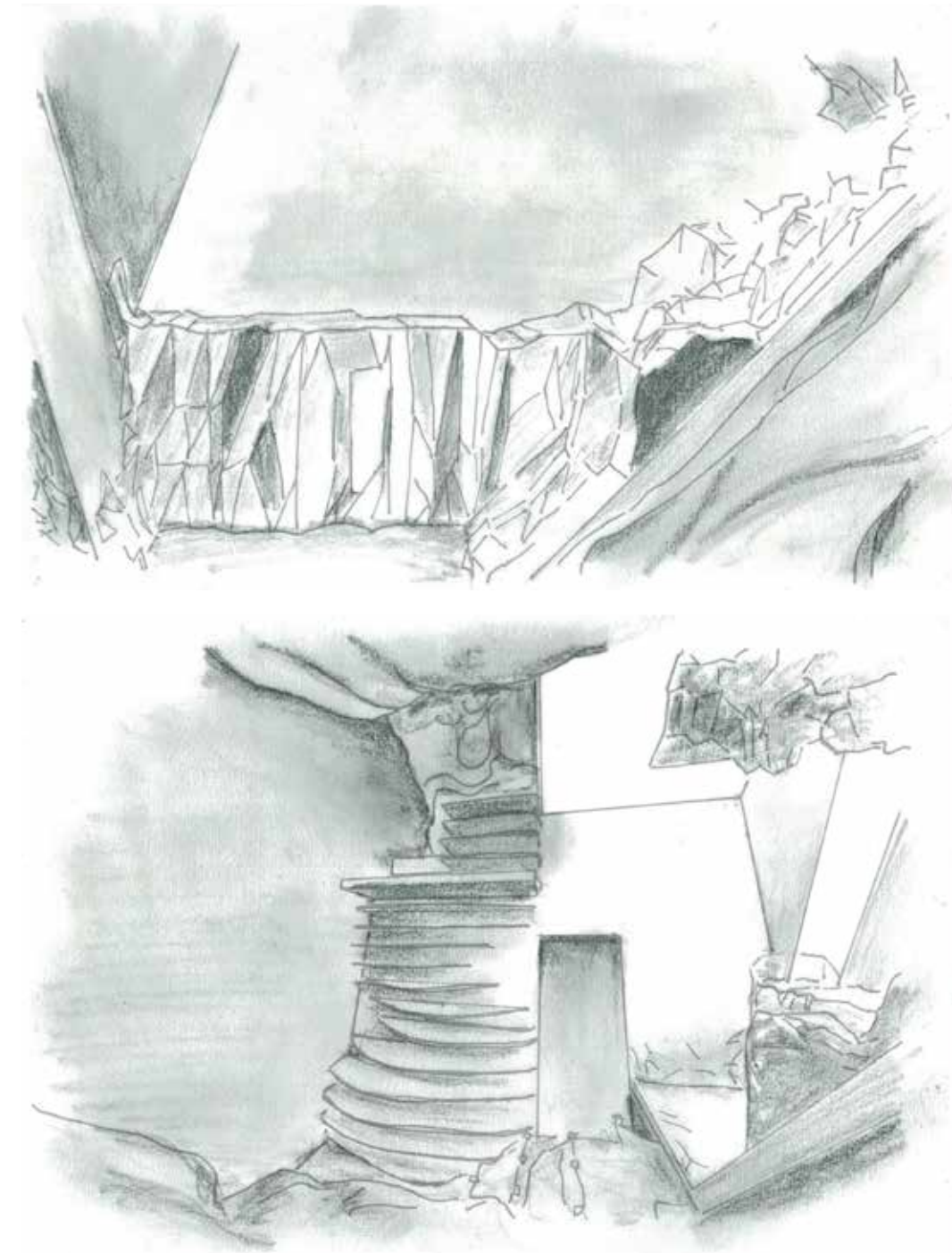
After this, strip lighting was added into the digital model in different locations. Interesting shadows were cast on the model and the forms of the polysurfaces were accentuated. The accuracy of these was questionable though, as the polysurfaces appeared to allow light through. This led to the question of whether the polysurfaces could be made from semi-transparent materials in some places.







Because there were questions raised about the accuracy of the digital model, and the computer program was causing some unnecessary challenges, the process moved back to analogue. The physical model from stage 2 was utilised for this. Panels were made up with different materials in them, then light was shone through these to cast patterned shadows over the surfaces of the model. This brings back ideas from previous chapters, where shining light through different textured materials can have a significant effect on the atmosphere created.



A quick sketch study into how the lighting would be affected by the two skylights created through openings in the initial volume geometries.



# colour

Within the realm of interior architecture, colour serves many purposes. It can affect the proportions and sense of weight of a room or object, define form, communicate a message, and create an atmosphere. Colours also can produce both positive and negative emotional reactions due to mood associations. People require sensory variety in their environments. Colour is a key element in providing this. No colour ever appears alone, but always in the context of other colour, whether they are directly beside each other, across a room, or even within different room of a building. The appearance of colours can be altered significantly by the combinations and relationship between them. (Faulkner, Mahnke, Miller).

The character, proportion, and legibility of a room can be greatly influenced by the location of colour within. This is because colours are generally perceived as either advancing and receding, so have the power to create illusion. Receding colours tend to be lighter, paler, and cooler colours as well as smaller patterns. These increase the apparent room size. Advancing colours are generally darker, more saturated hues, warm colours, and larger patterns. These can decrease the apparent room size. They have the reverse effect on objects, however, with darker, warmer colours making an object appear heavier and larger, while objects that are lighter, or cooler colours are perceived as lighter in weight and smaller in size. Changes in the structure of the building can be camouflaged through colour, as well as connecting or

disjoining architectural planes. Advancing colours can be utilised to stop or deflect movement, divert attention away from certain areas, and draw attention to other areas. When used on the ceiling, advancing colours can lower its perceived height. This is especially prominent when used in conjunction with a floor of the same colour, and receding colours on the vertical surfaces. Receding colours on the ceiling have the reverse effect, especially with advancing colours on the walls. (Faulkner, Mahnke, Miller).

Temperature is a tactile element of colour. Warmth or coolness can be suggested by certain colours, as well as the physical temperature of certain objects being communicated through its colour. Colours generally considered hot or warm are red, orange, brown, and most yellow hues. Most greens and blues are considered cool or cold colours, though certain tones and hues are perceived as warmer. Colours such as pink and violet can change depending on their hue position as well as the surrounding colours within the environment. Experiments have shown that a person will feel colder in a blue room than an orange room despite the physical temperature of the room being the same. (Faulkner, Mahnke, Miller).

Colour and light are inseparable. Without light there is no colour, and until reflected by a surface, light is invisible. Both are key elements of any architectural environment and have immense impact to psychological reactions and physiological wellbeing. Colour can be used to

communicate, express, and manipulate a person's emotions. (Faulkner, Mahnke, Miller).

There are many theories on colours and their associated emotions which are widely available. For clarity, this research will only consider the work of Waldron Faulkner, Frank Mahnke, and Mary Miller. It is noteworthy however that colour takes different meaning across cultures. For the purpose of this design-led research the following colours definitions will be applied:

Red: There are many emotions and associations made to this strong and dominant colour. It is seen as exciting, stimulating, arousing, passionate, and sensual. It radiates warmth, intensity, fierceness, rage, aggressivity, and activity. Red is the colour of blood and therefore of life, combat, war, and sacrifice and sin. Seen as a masculine colour, red brings to mind fire, hot embers, and energy. It is perceived as an advancing colour, with orange-reds being the hottest of colours. It is a dynamic and sometimes quite distracting colour. When red is lightened to pink it becomes a more feminine colour, gentle and acquiescent, though still strong and sensual. (Faulkner, Mahnke, Miller).

Orange: An exciting and stimulating colour, orange is seen as energetic, jovial, sociable, lively, and extroverted. Light orange is cheering whereas higher-saturated oranges can be seen as intrusive and blustering. Orange is mellow and



Figure.214: reference images from chapter 3 that inspired this step of the process



less primitive than red and brings strong autumnal associations. (Faulkner, Mahnke, Miller).

Brown: Darkened orange, the colour of the earth and wood. Brown has strong links to comfort, security, and stability, as well as gustatory associations such as chocolate and coffee. Brown can appear motherly and dependable, but also glum, drab, and grubby. (Faulkner, Mahnke, Miller).

Yellow: The happiest of colours, yellow is reflective, luminous, cheerful, sunny, and high-spirited. It brings thoughts of hope, wisdom, activity, communication, and mental and spiritual enlightenment. It is an expansive and advancing colour. When too strong, yellow can become glaring, egocentric, and aggressive. (Faulkner, Mahnke, Miller).

Green: The colour of the natural world, green is tranquil, refreshing, calming, quiet, and relaxing. Green is the colour of life, fertility, growth, hope, spring, nature, resurrection, and immortality. Sometimes seen as retiring, common, and tiresome; some hues bring on connotations of mould, guilt, decay, sickness, death, poison, and nausea. (Faulkner, Mahnke, Miller).

Blue: A calm, relaxing, and tranquil colour, blue is the colour of peace, hope, truth, spirituality, wisdom, hope, serenity, restfulness, piety, heaven and immortality. Blue inspires trust, security, confidence, contemplation, yearning, and sobriety. Sometimes frightening, depressing, melancholy, cold, and wet, blue is the colour of sadness and of the sea and sky. The Peacemaker colour, blue embodied ideas or passivity, quietness, comfort, sobriety, dignity, poise, mental reflection, and reserve. It is the colour of

cleanliness and odourlessness. Despite being generalised as a cool colour, some mid-value and deep blues can appear quite warm. This is heavily influenced by the material it appears on. Blue is usually perceived as a receding colour; however, a highly-saturated 'electric' blue can be a strongly advancing and energising colour instead. (Faulkner, Mahnke, Miller).

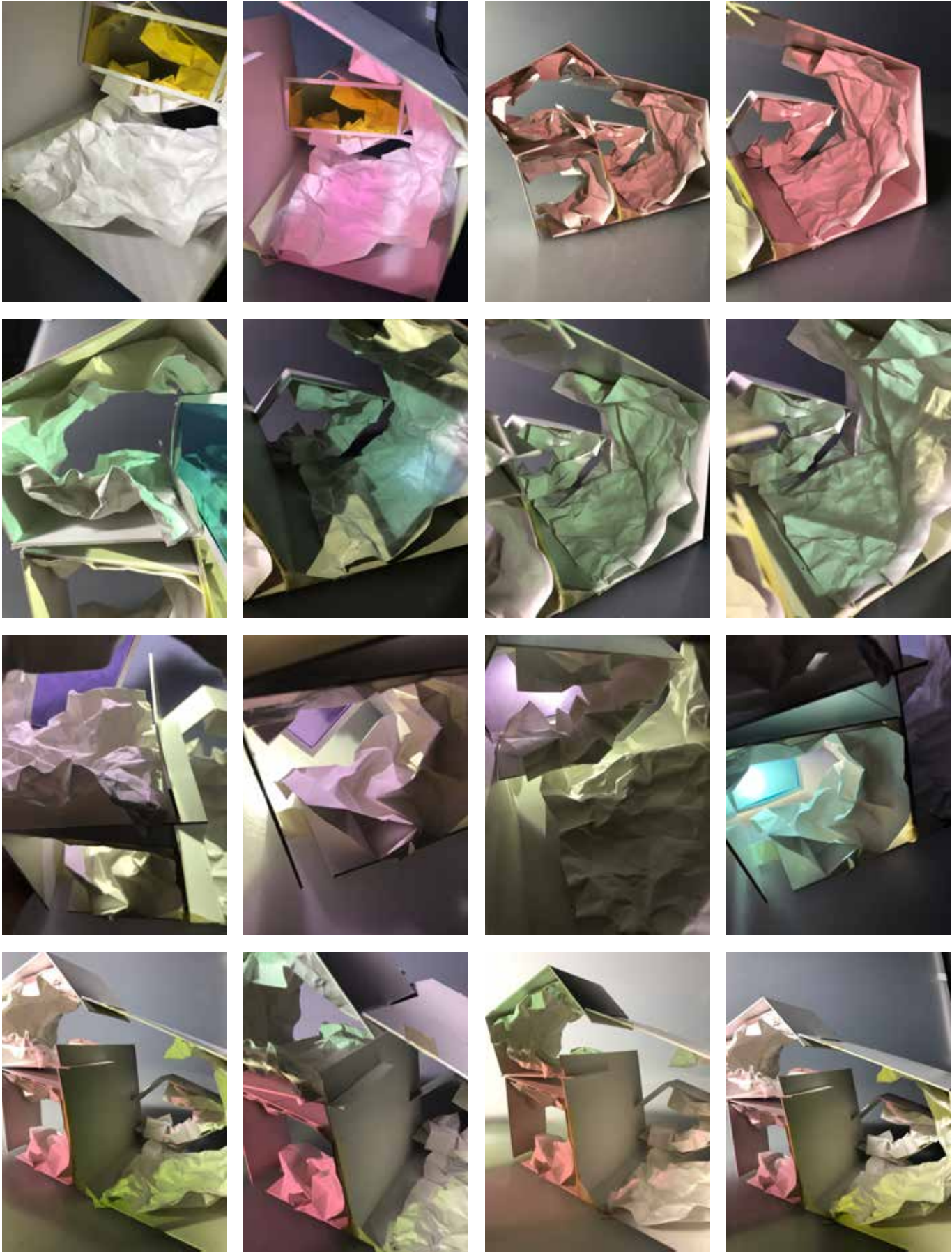
Purple/violet: Originally the colour of royalty, purple is regal, dignified, exclusive, pompous, mournful, clerical, and lonely. It speaks of integrity, strength, magic, wealth, richness, delicacy, majesty, splendour, mysticism and euphoria, as well as the internalisation and depth of feeling. Darker shades can carry a sense of foreboding, where closer to red it becomes more seductive, sensual, intimate, sweet, and secretive. Unsettling, morbid, degenerate, and narcotic are some of the perceptions of certain nuances of purple. Shadow and twilight, ephemeral, and intangible are other ways in which purple can be perceived. (Faulkner, Mahnke, Miller).

White: The colour of joy, light, purity, hope, holiness, innocence, goodness, and peace, white is clean, sterile, and neutral. White can represent new beginning, nirvana, submission, and spirituality. It is bold, assertive, unemotional, static, and inclined towards coldness. White can provide a light airiness, or be described as dead. It can be boring, tedious, and touch inhibiting. White picks up hues reflected off other surfaces, and provides a strong value contrast against other colours. Adding grey tones make it colder, whereas adding earthy tones bring warmth to it. (Faulkner, Mahnke, Miller).

Black: A sign of status or of fear, there are two opposing sides to black. It can be ominous, defiant, and powerful, bringing

forward a fear of the unknown, hatred, grief, death, and self denial; or it can display richness, elegance, sophistication, luxury, dignity, and quality. When used alongside other colours, black heightens them and makes them appear more luminous. (Faulkner, Mahnke, Miller).

Grey: Through a tendency to take on characteristics of adjacent colours, grey is neutral, neither warm nor cool, neither tension nor relief. Grey is passive, conservative, calm, quiet, dreary, tedious, and without life. It is a modern and industrial colour that relates to things man-made, concrete and metal. (Faulkner, Mahnke, Miller).



Shining light through transparent coloured screens onto the physical model from stage 2 of the design process was a good way to begin colour experimentation. It brought back methods from previous chapters as well as starting to create unique atmospheres. Some of the colours were done in conjunction with textures to combine colour and shadow.

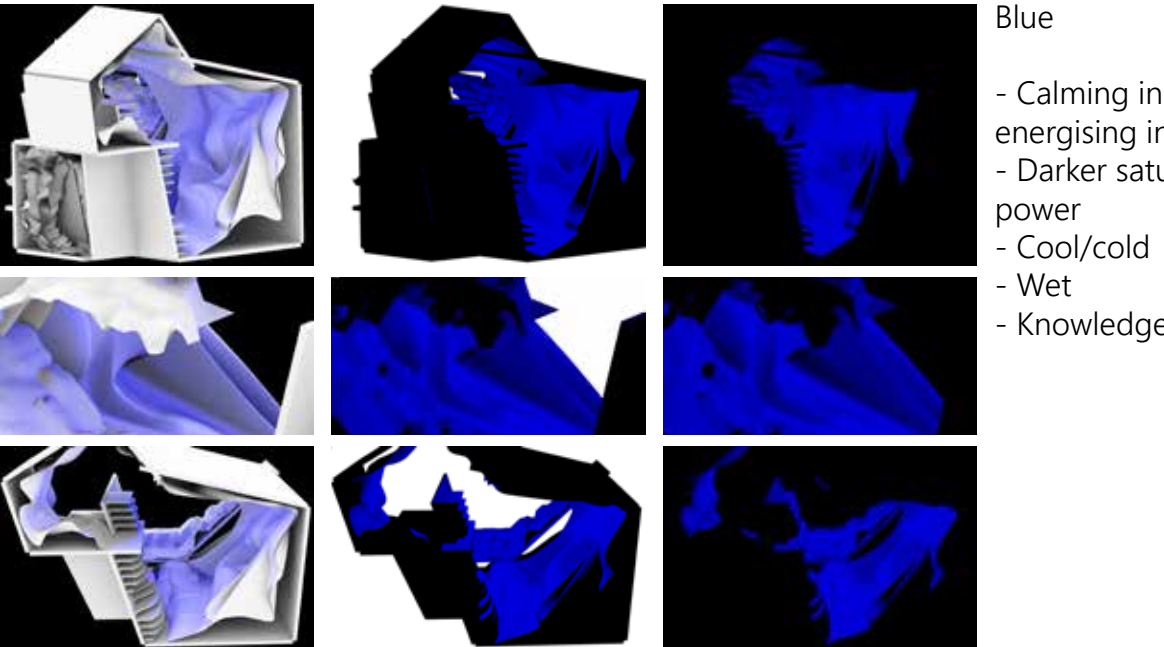


Using a light that projects colour onto the surfaces helps to understand the effects of certain colours within the space. Key words and thoughts are pulled out beside each colour experiment.



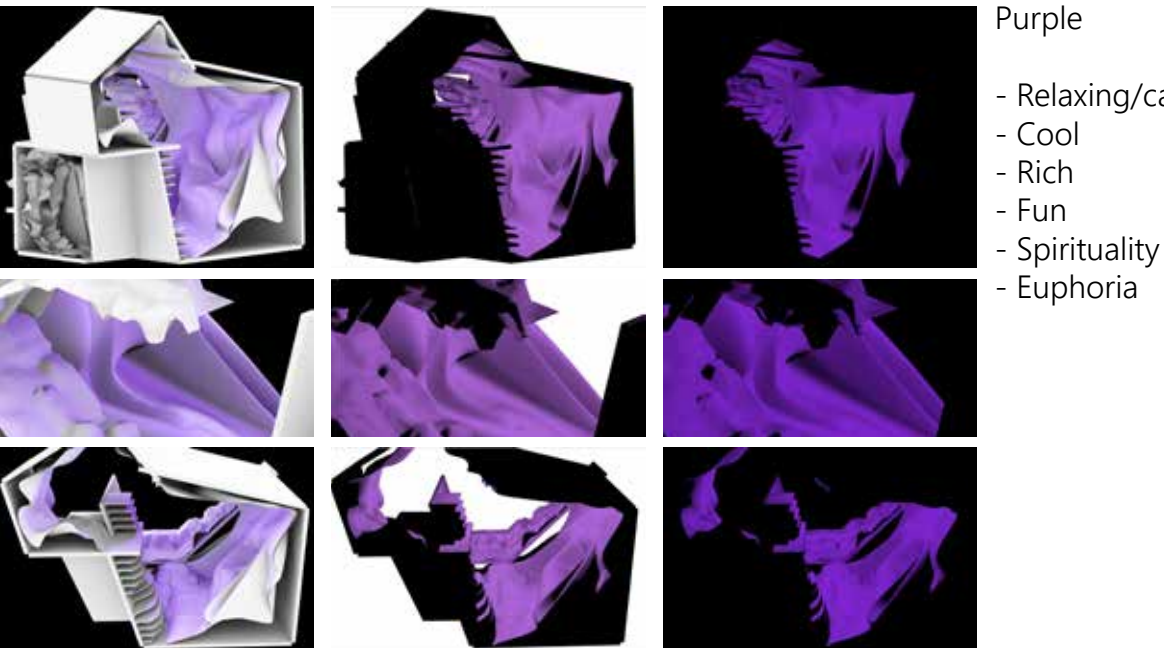
Turquoise

- Calming
- Warm
- Peaceful
- Tranquility



Blue

- Calming in paler tones but energising in full saturation.
- Darker saturation evokes feelings of power
- Cool/cold
- Wet
- Knowledge

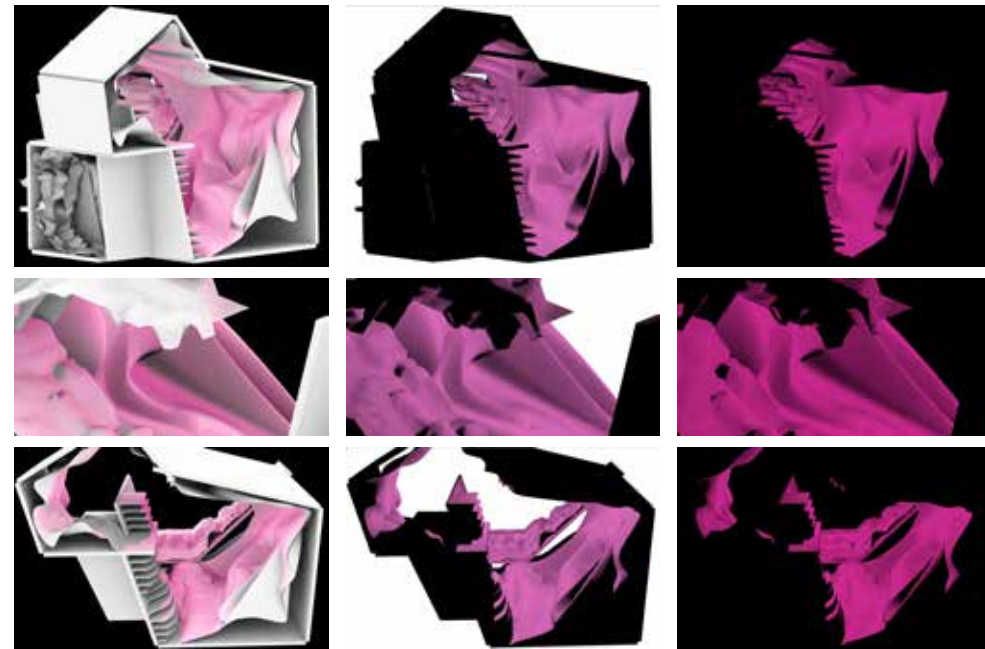


Purple

- Relaxing/calming
- Cool
- Rich
- Fun
- Spirituality
- Euphoria

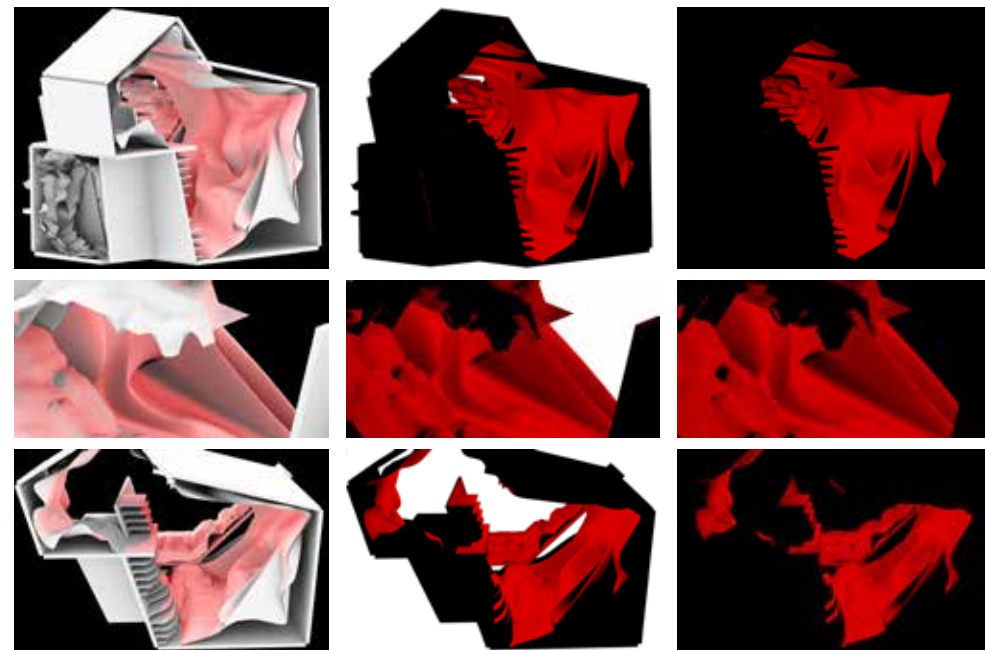
Figures.216-218





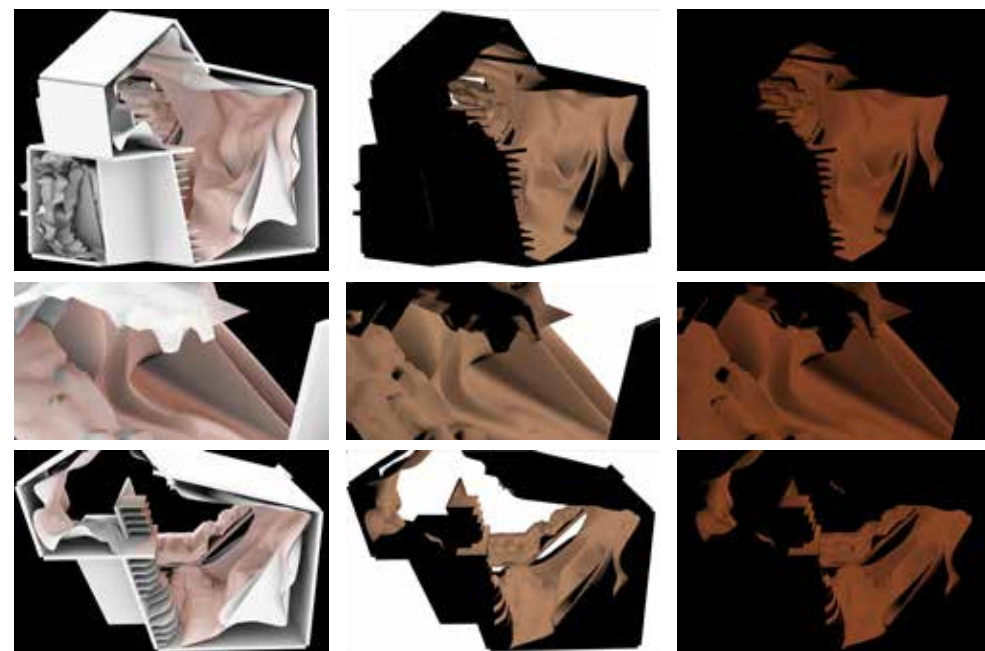
## Pink

- Warm
- Sensual
- Love
- Connection
- Intimacy
- Passion



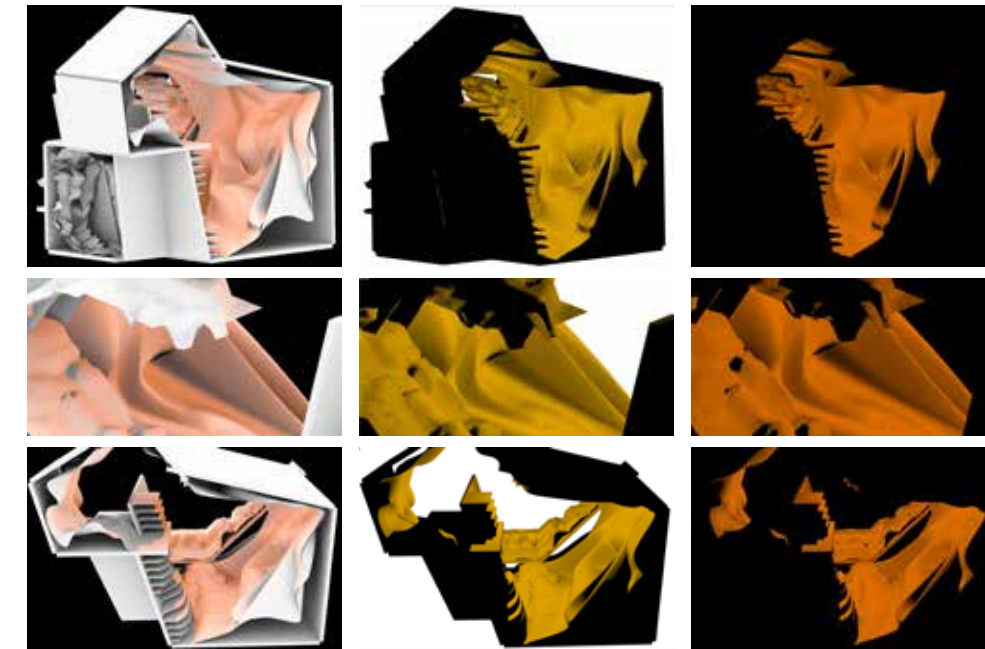
## Red

- Warm/hot
- Energising
- Angry
- Passion
- Seduction
- Fire



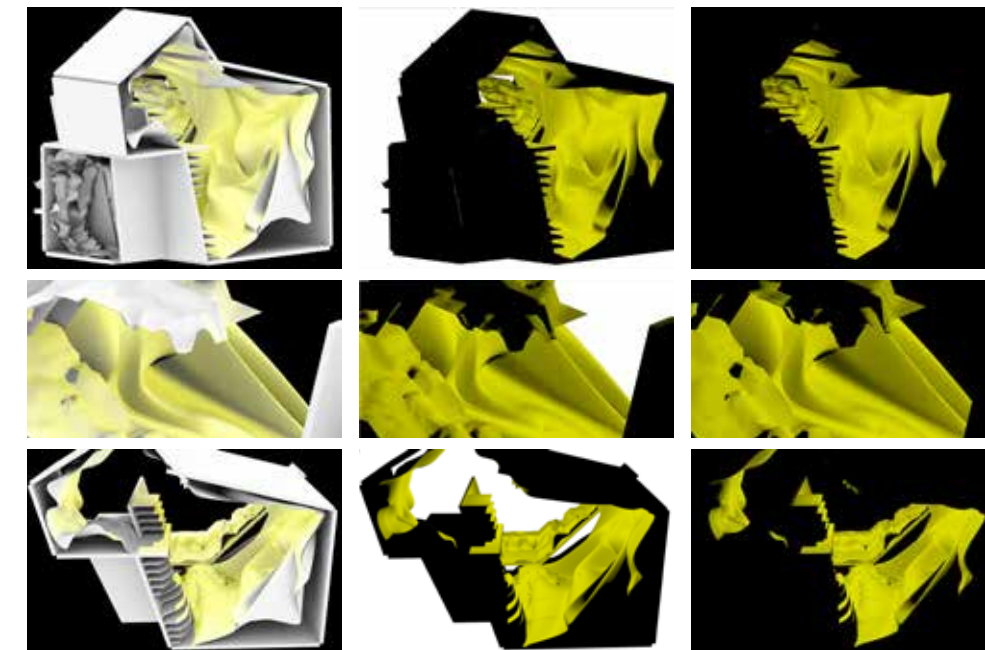
## Brown

- Warm
- Calming
- Earthy
- Chocolate
- Coffee
- Nature
- Strength



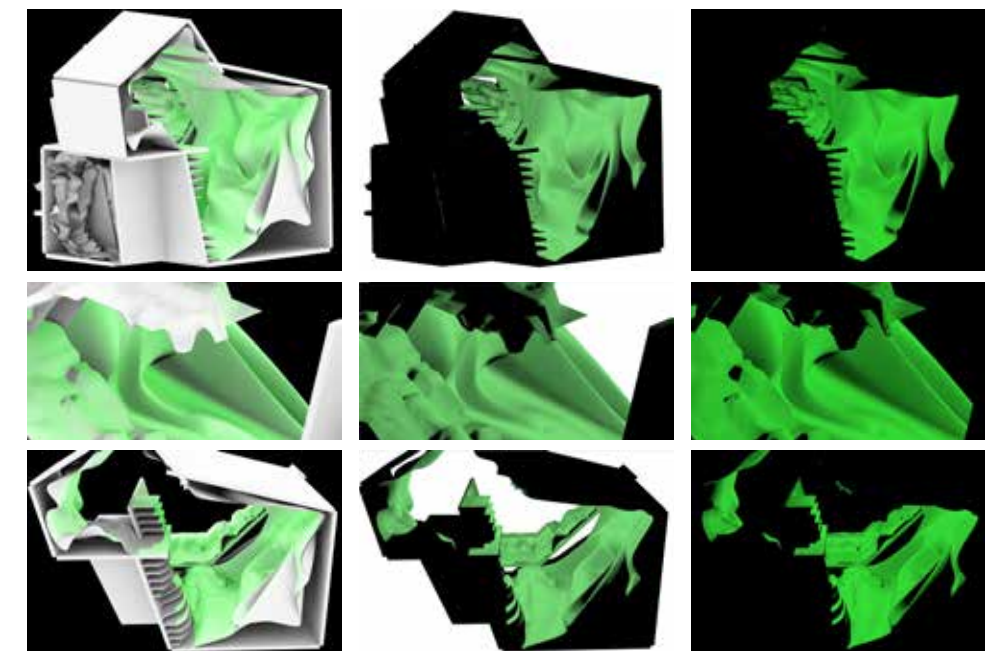
## Orange

- Warm
- Energising
- More yellow tones are reminiscent of honey
- Orange tones that drift more towards earthy/brown spectrum are more calming as more pleasing and softer on the eye
- The more yellow based/golden colours are more calming
- Reddish hues are energising and reminiscent of fire



## Yellow

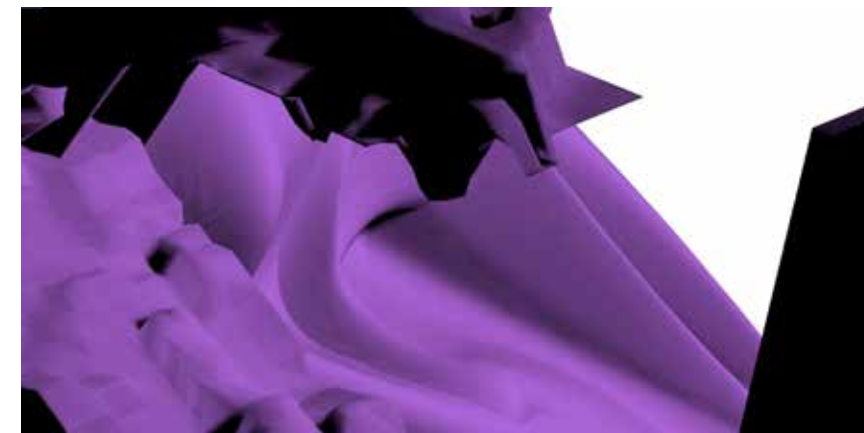
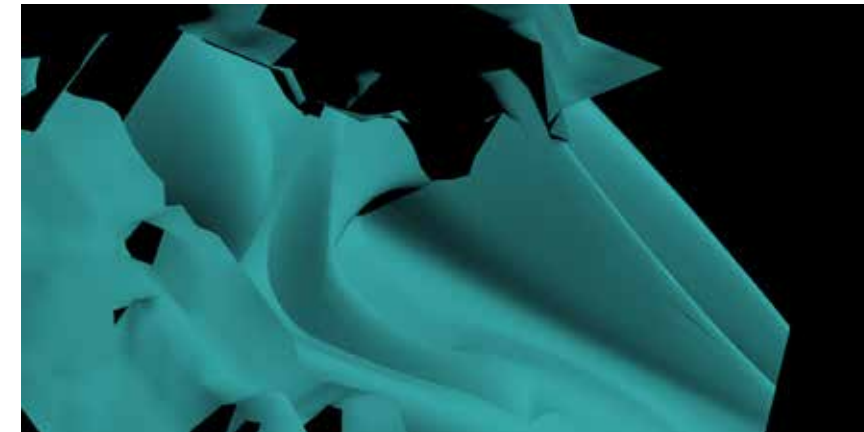
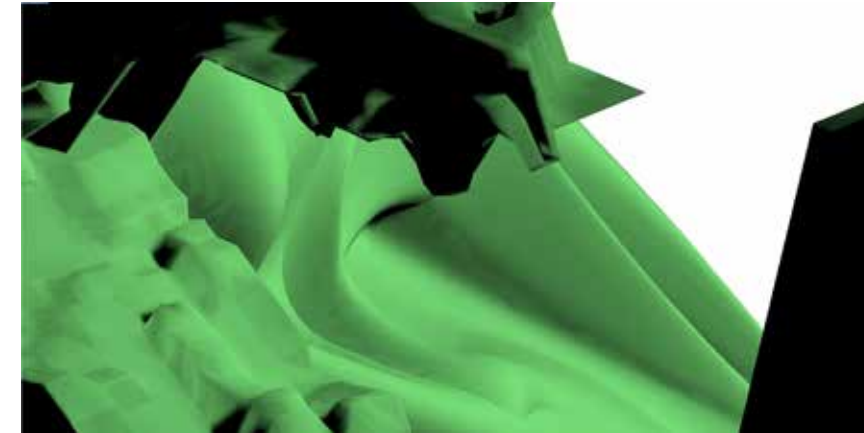
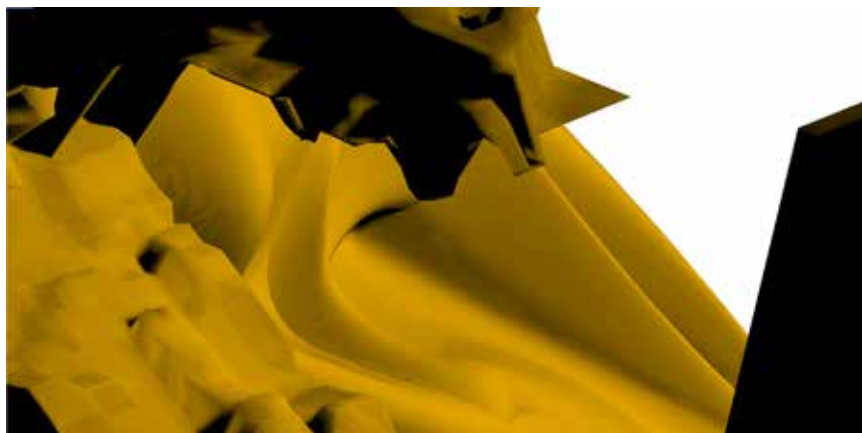
- This particular yellow is quite cold and unnatural
- The higher saturation is sickly
- Lower saturations are happy and summer-like
- More orange-based yellows could be warmer and happier



## Green

- Cool
- Angry
- Energising
- Because this is quite an unnatural green it is poison-like, and evokes fear.
- Deeper greens would evoke more feelings of nature, relaxation, rejuvenation, tranquility, and peace







Colours were then applied to the surfaces of the volumes, and the polysurfaces within. These were informed by the emotive qualities that each room should evoke.

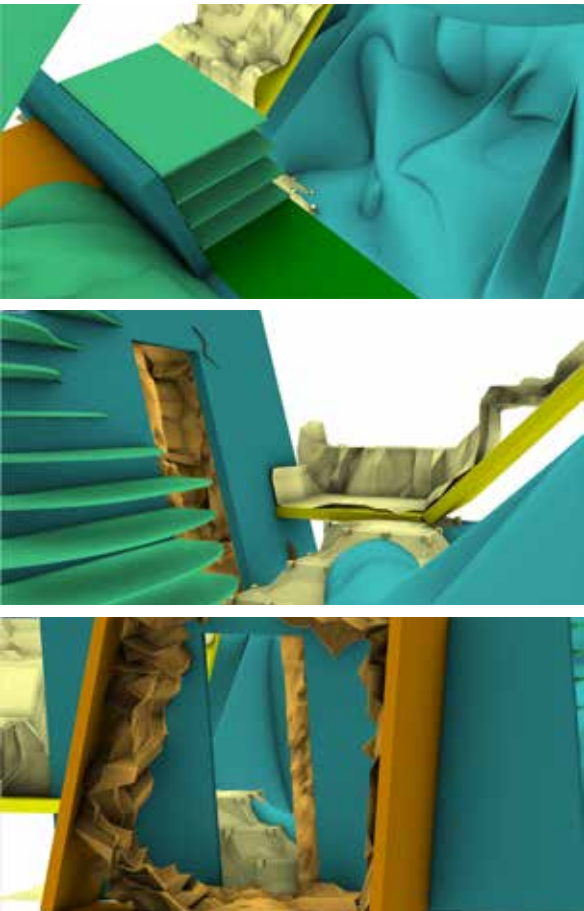
Bedroom: calming, relaxing, tranquil, restful, intimacy, warmth, twilight.  
Colours associated with these qualities are green, blue, and purple.

Living area: calming, relaxing, comfortable, social, jovial, warmth  
Colours associated with these qualities are green, blue, and orange.

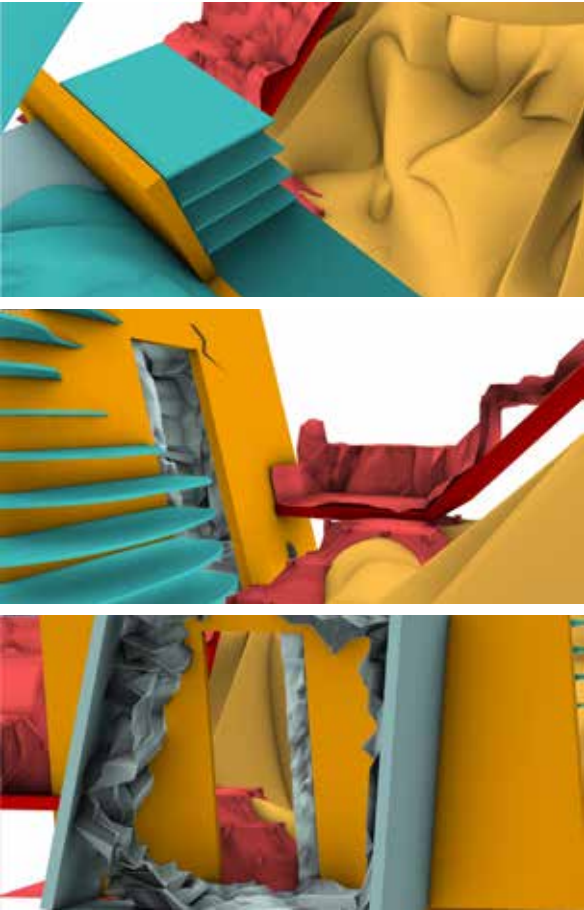
Bathroom: clean, refreshing, hygienic.  
Colours associated with these qualities are white and pale or light blue.

Kitchen: clean, food, activity, warmth, hygienic.  
Colours associated with these qualities are white, brown, yellow, orange, and red

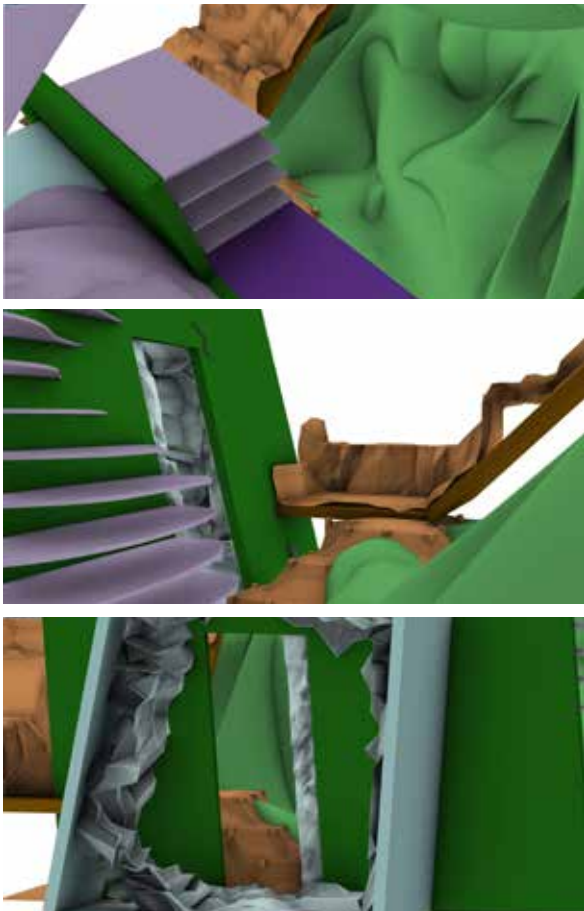
The first experiments looked purely at different colour combinations with the final two experiments in this set developing the more successful of these.



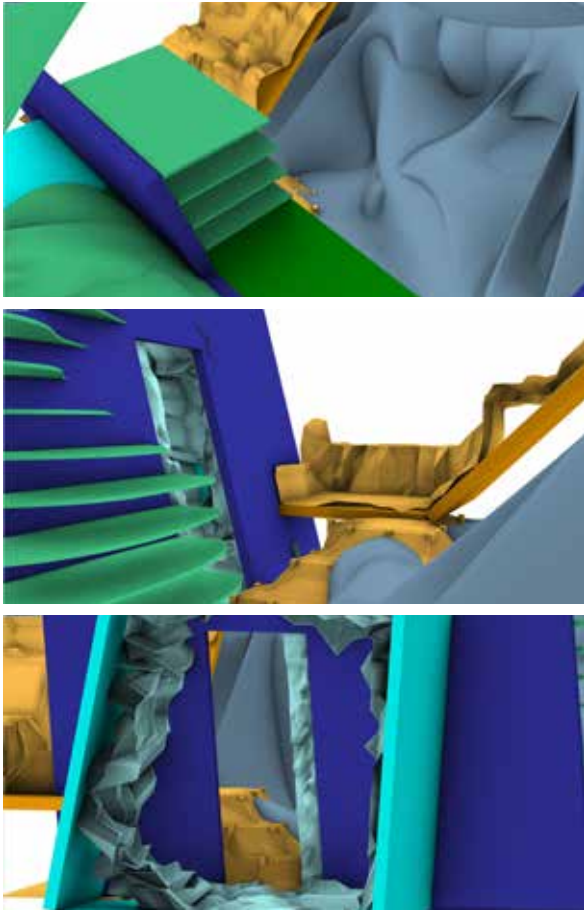
1.  
Bedroom - Green  
Living area - Blue  
Bathroom - Orange  
Kitchen - Yellow



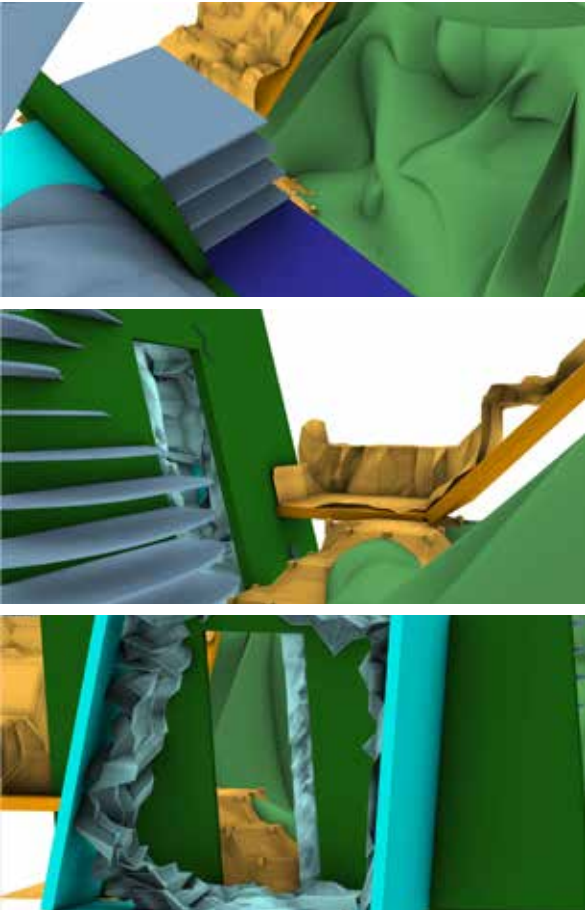
2.  
Bedroom - Blue  
Living area - Orange  
Bathroom - Pale blue  
Kitchen - Red



3.  
Bedroom - Purple  
Living area - Green  
Bathroom - Pale blue  
Kitchen - Brown

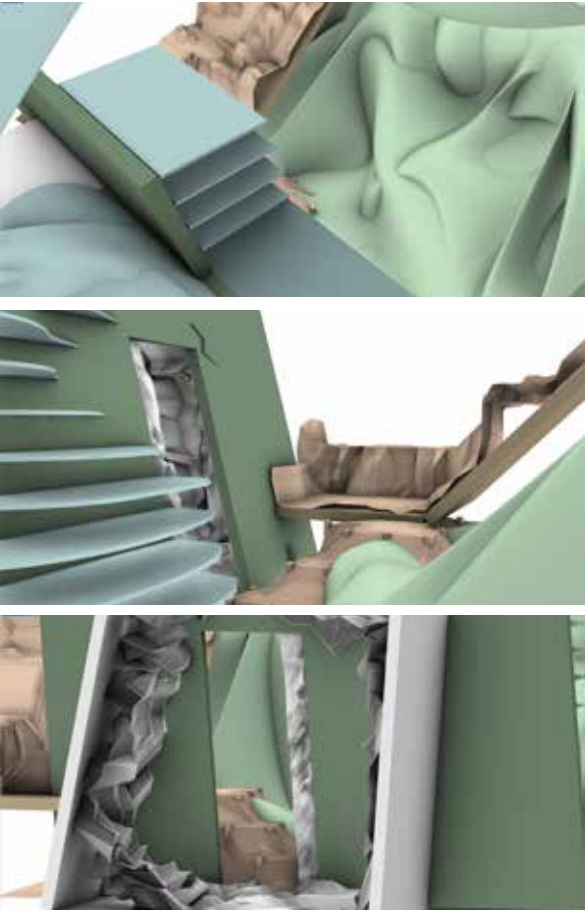


4.  
Bedroom - Green  
Living area - Blue  
Bathroom - Light blue  
Kitchen - Orange



5.  
Bedroom - Blue  
Living area - Green  
Bathroom - Light blue  
Kitchen - Orange

Ultimately this was chosen as the best choice of colours to use for each space due to sufficient contrast levels and colours that evoke the right emotions. The colours are very strong though, and need to be pulled back somehow. This was explored further and challenged in the next stage of design.



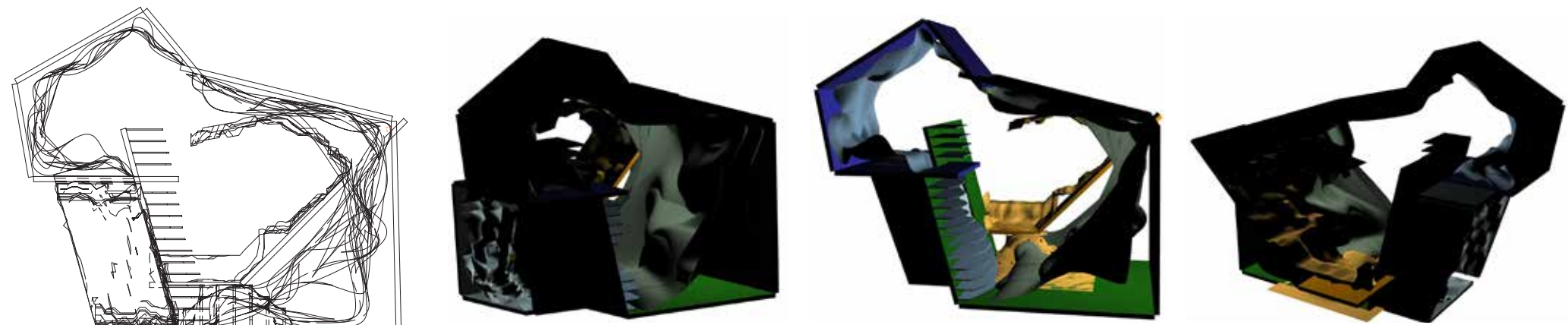
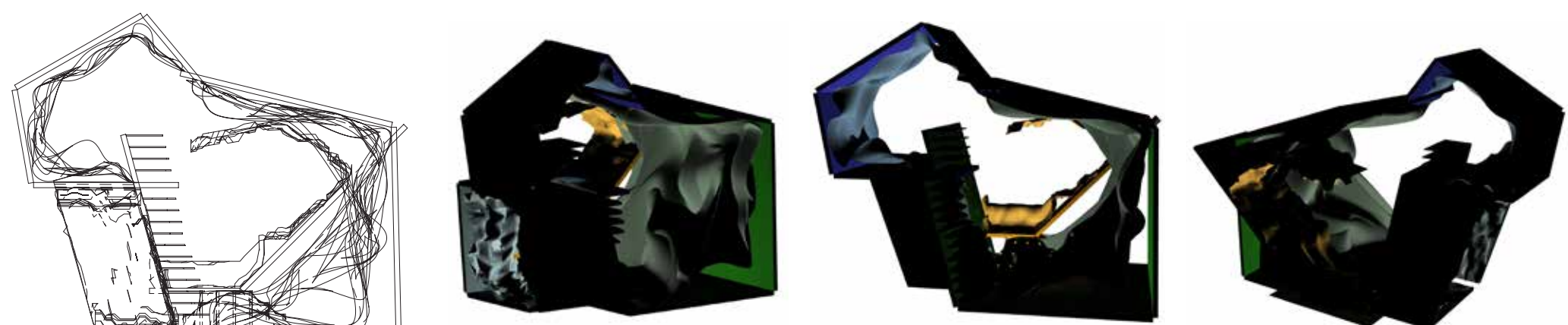
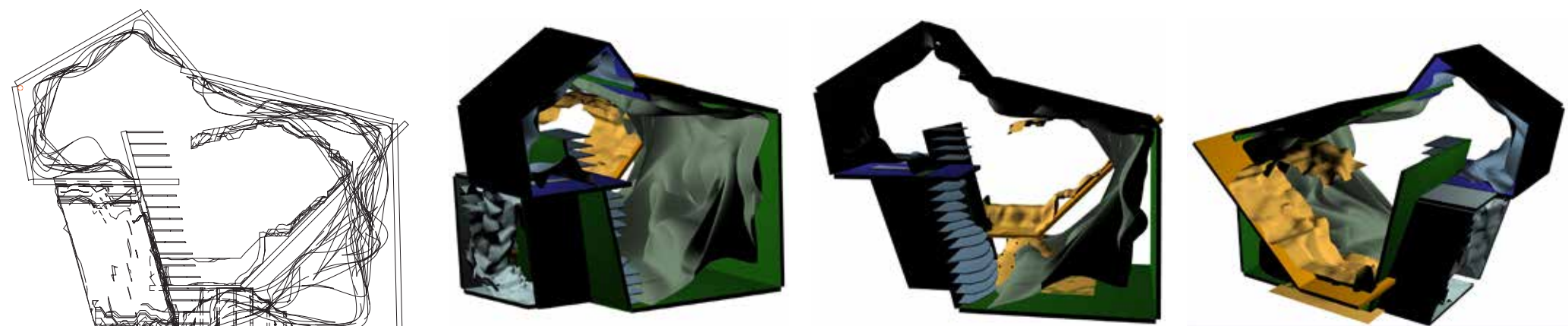
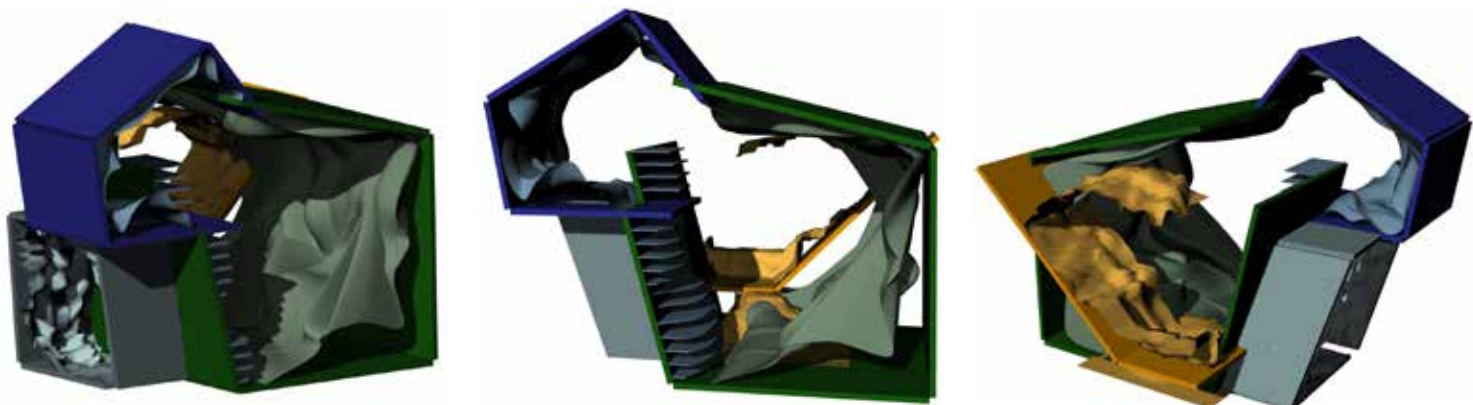
6.  
Bedroom - Pale blue  
Living area - Green  
Bathroom - White  
Kitchen - Brown

Toning down colours to less vibrant versions of themselves leads to a significantly reduced contrast between them.



colour & light

Lighting and colour were looked at simultaneously. Using surface colour and white light in different locations, the shadows and effects of colour were explored. Some of these were more successful than others, though realistically, the qualities of light would depend on the specific qualities of the material itself. The colours themselves appeared to change slightly with the addition of light and shadow, and many of the forms were accentuated.





# materiality

Materiality was the last step of stage four. Materials were chosen for their tactile experience as well as the practicality of each surface within a space. Findings from earlier research informed the decisions made about materiality. The floors of each space had to be quite firm or have a thin surface covering so that walking across them is not made difficult. The walls and polysurfaces had more flexibility with thickness and the level at which they could mould around the body. There were many different textures that could be applied to each surface. The bedroom and living spaces would be a comfortable and inviting space, so softer fabrics and cushioned surfaces would be suitable in these spaces. The bathroom and kitchen, however, would require harder and more durable surfaces, as there is often a lot of water and cleaning required in these spaces.

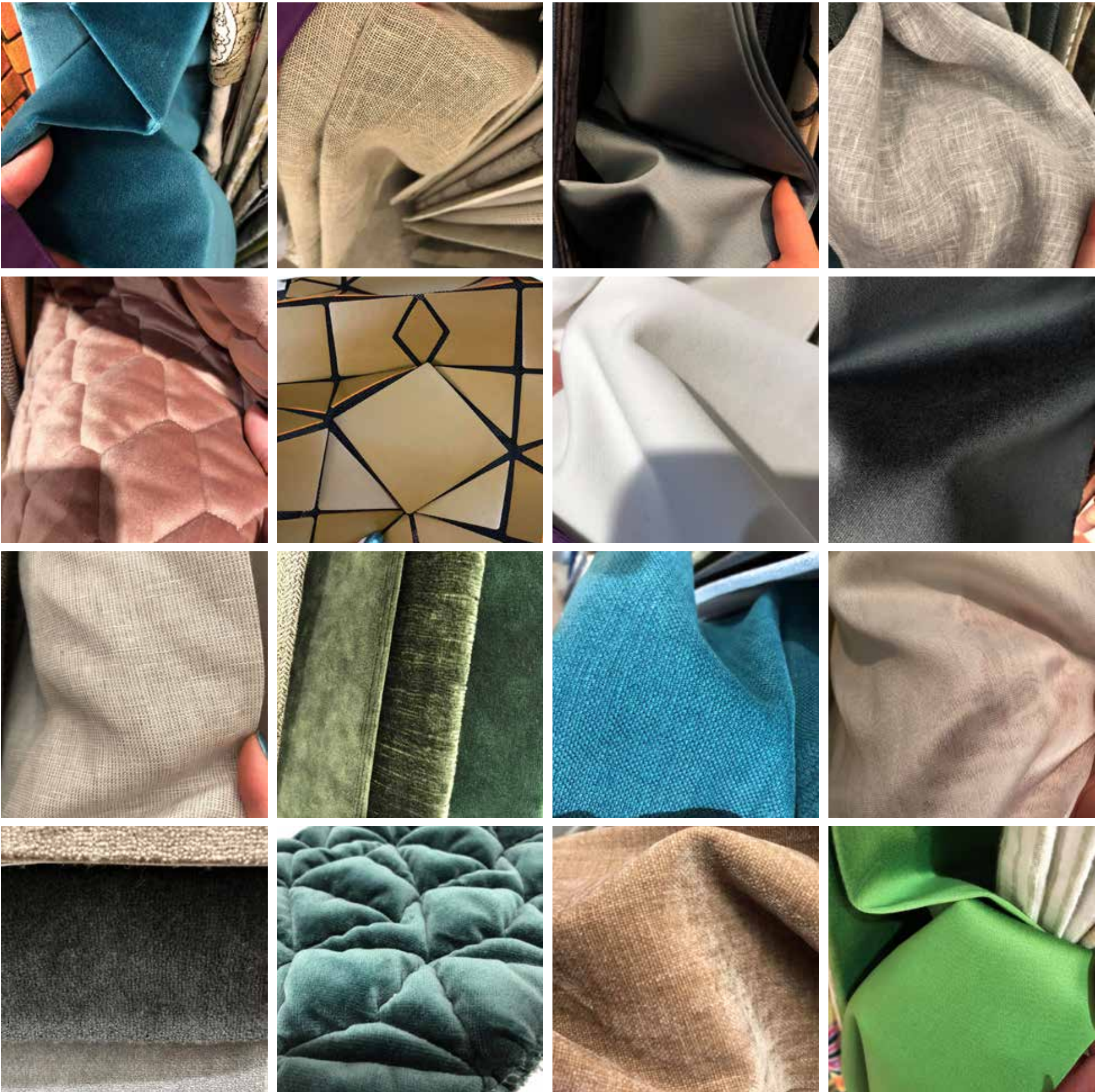
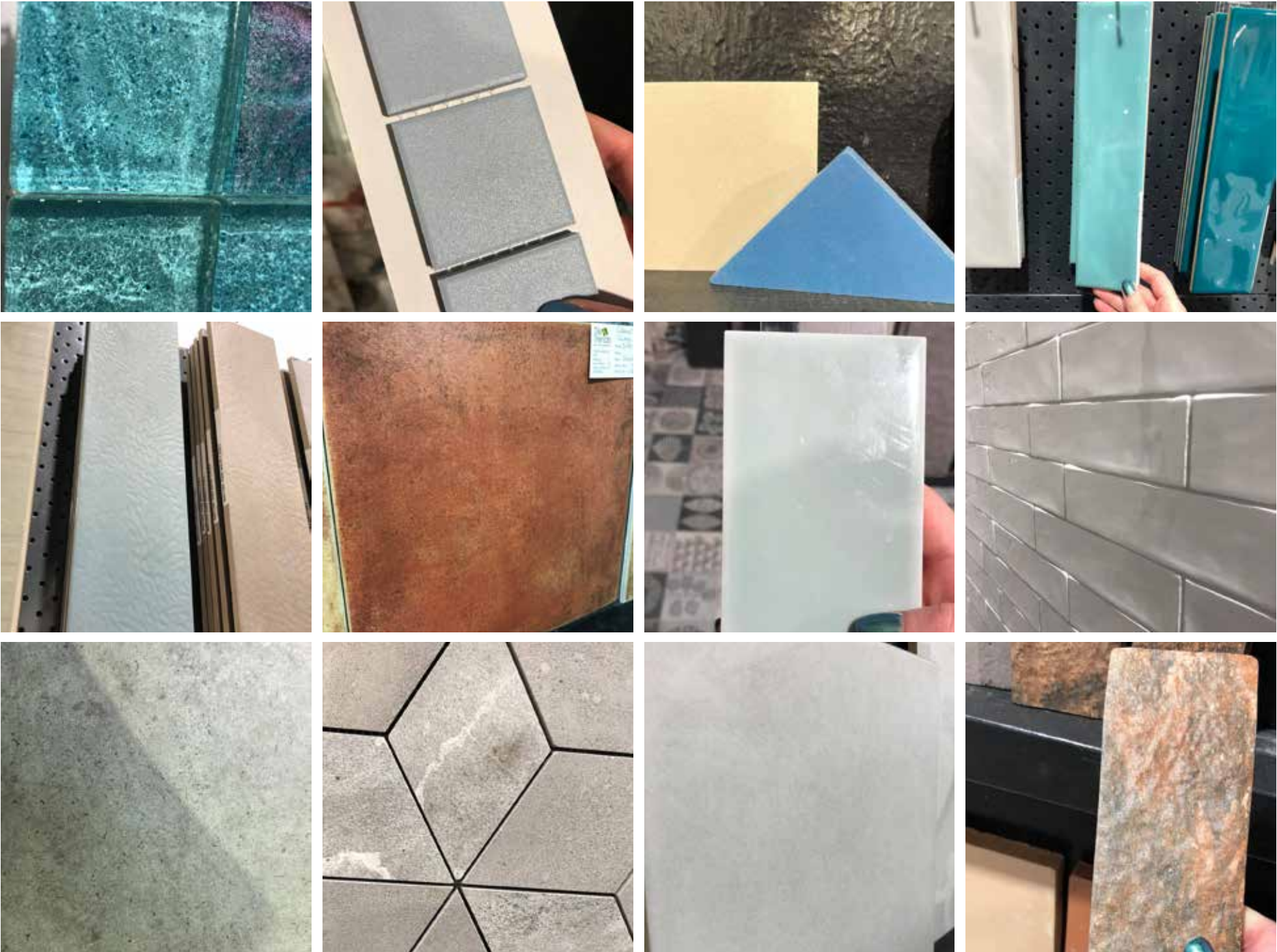
Texture prints taken earlier in the research were used as a starting point for tactile surfaces. Three of these prints were repeated to see how the texture and appearance change when applied to a larger surface. After this, multiple stores and design libraries were visited to explore softer material options.



Figure.235



Exploration into potential materials was done through touching everything with the hands. Those with an interesting or pleasant surface were identified and singled out.





Material Qualities



cool temperature  
hard grainy



rough hard cold



variable temperature  
uneven



sleek glossy cold



smooth cold  
hard



lumpy cold  
fluid



hard coarse  
cold



cold coarse  
hard



sleek glossy  
cold



variable temperature  
hard uneven



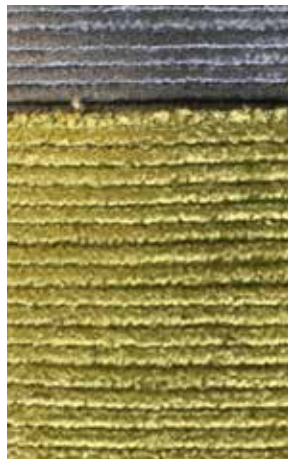
impressible  
soft spongy



bumpy warm  
plush



soft coarse  
flimsy



bumpy warm  
thick



sleek silky  
cool



uneven warm  
soft



cool smooth  
glossy



warm smooth  
soft



velvety warm  
soft



warm soft  
smooth





Samples were collected and grouped based on their tactile qualities and colour. A focus was placed on using samples in the colours of the areas in which each material could potentially be used. Where these were not available, other colours of the same tactile quality were utilised.



A more refined selection of textures were used to create an initial mood board of finishes to be used in the small home interior.



## Stage 5 : Extraction

The final stage of the process began by revisiting all of the key criteria specified in the framework, as well as reducing volume sizes in any areas that expanded during the design process. This was left until stage five because implementing them too early on would have had a strong effect on the design outcomes and significant control over certain design decisions. Although some semblance of buildability was considered throughout, through temporarily side-lining these criteria the design was pushed further than it would have otherwise been.

By this stage the design was oversaturated with volumetric, lighting, colour, and tactile elements. To make the design a functional home it needed significant refining and editing.

There are many ways in which to refine the design in order to create an effective and engaging outcome. The method chosen would depend on many factors such as the client, the criteria, the designer, and the context of the design. Each method of refining and editing would have a very different outcome so picking the one that fits best would be crucial. A few

of these methods are outlined. Two of these were explored further.

Examples for methods of extraction:

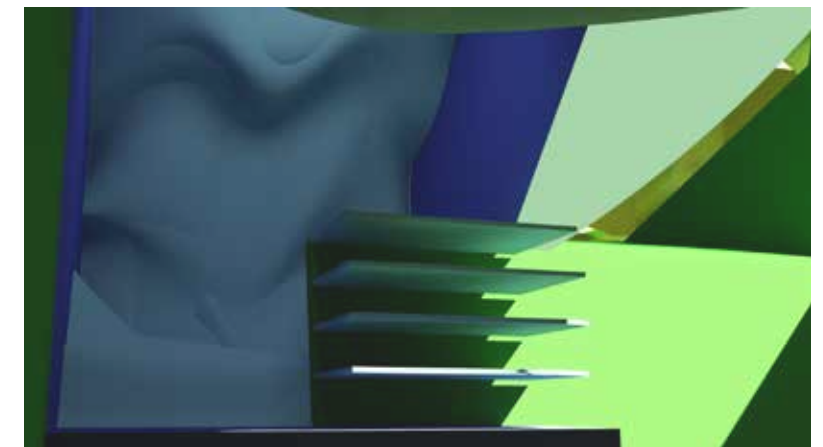
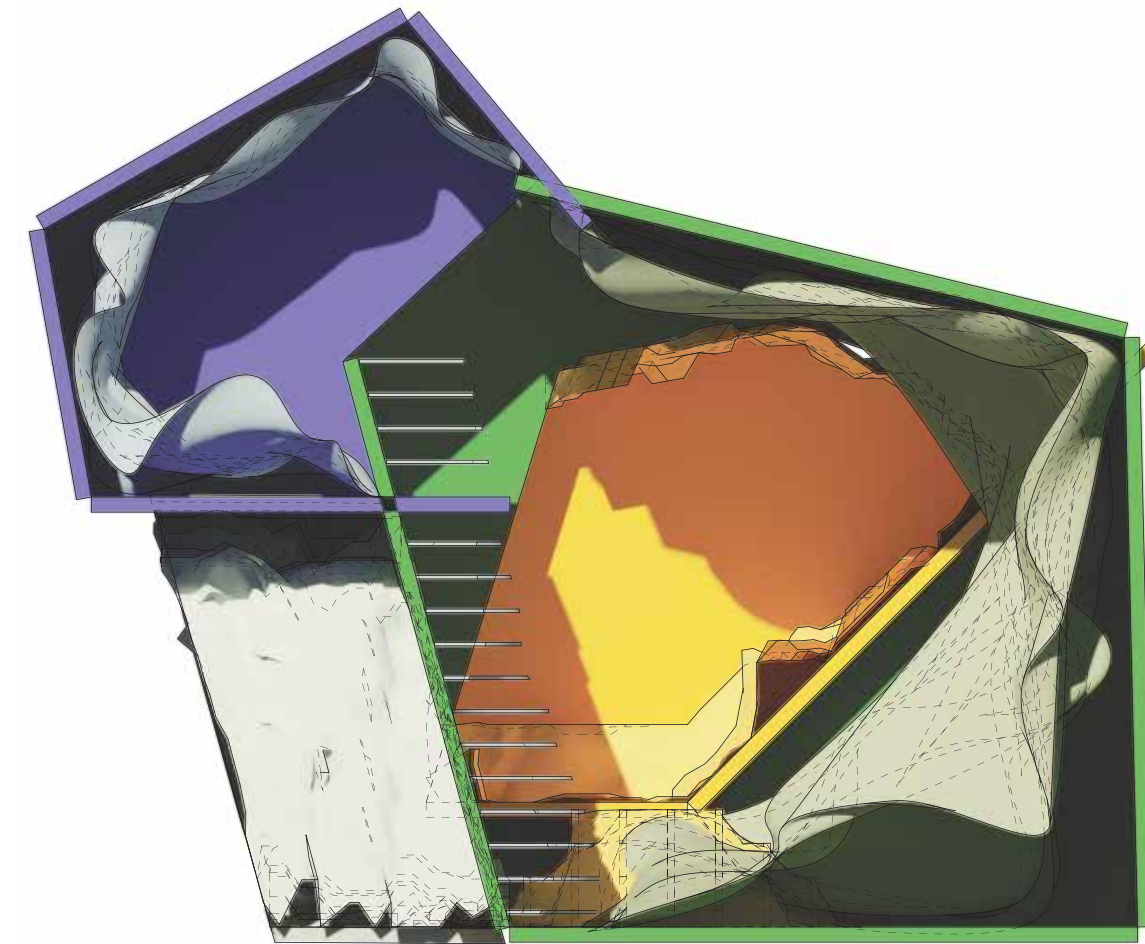
**Disruption** - A slice of the initial design is kept in full saturation of colour and tactile elements while the rest of the home is made completely white and orthogonal. This could also be reversed so that the disruption is a large stripe within which everything is white and orthogonal.

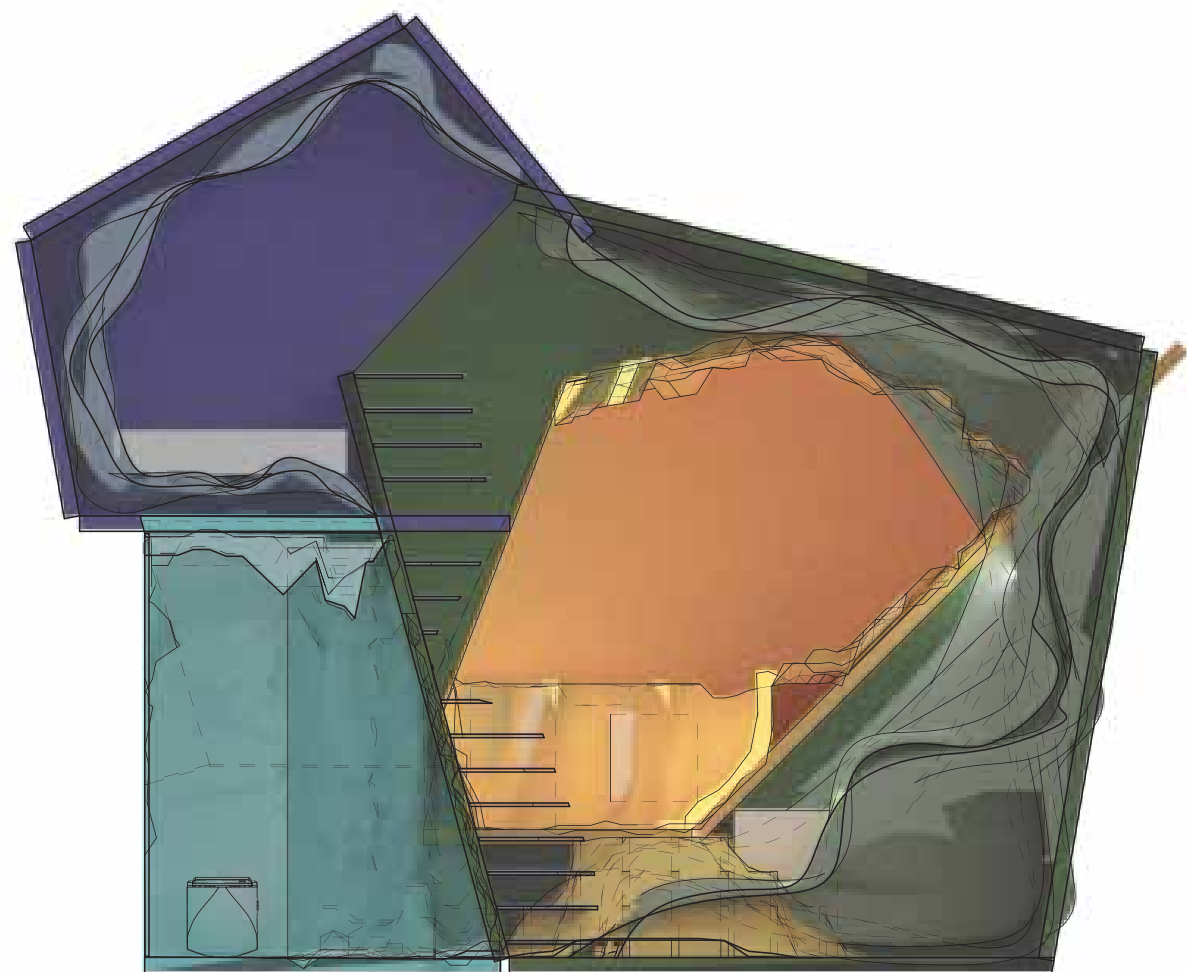
**Subtlety** - All polysurfaces and colours within the design are softened, expanded, or receded to be just a subtle hint of what was initially there.

**Parasitic** - Some specific elements of the design are kept. The rest of the design is standardised and orthogonal.

**Environmental** - Some rooms are kept in full saturation of colour and tactile elements; the rest are standardised and orthogonal.

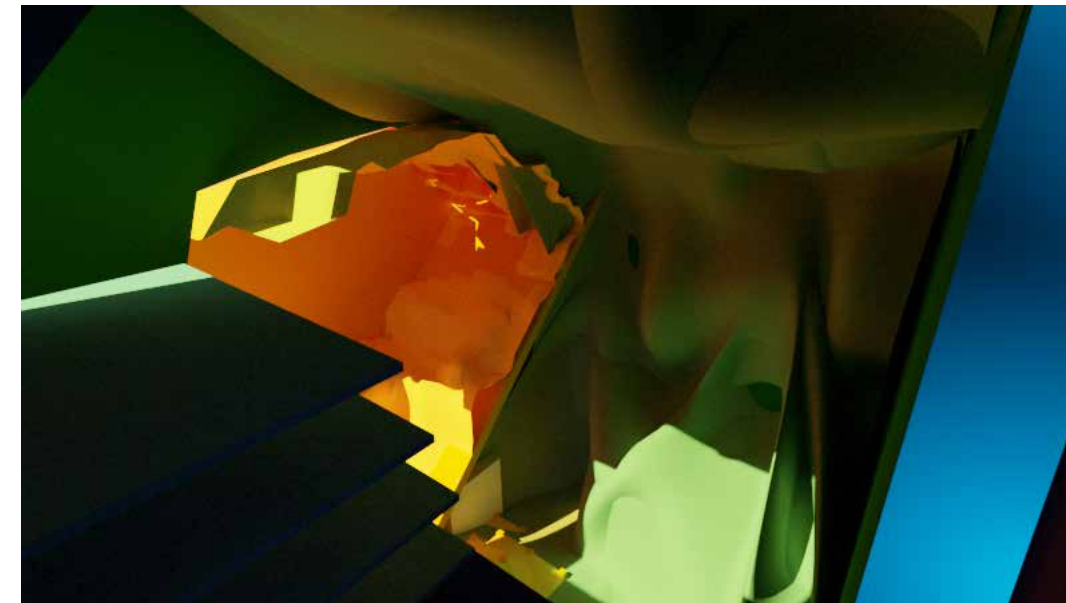
**Other** - A different designer going through the process may have an entirely method of refining that comes to mind.





The addition of elements required within the home such as a toilet, bed, and kitchen appliances were added first in this stage to ensure all living criteria specified were met. This process meant that certain volumetric elements were altered.

Next the volume of the house was calculated. It had expanded to 89.7 cubic metres, so needed to be reduced back down to 76m<sup>3</sup>. To do this the living space was reduced in width and depth. The kitchen was also moved further into the living space. The home was already below the maximum footprint size of 37m<sup>2</sup> so nothing needed to be altered for that.





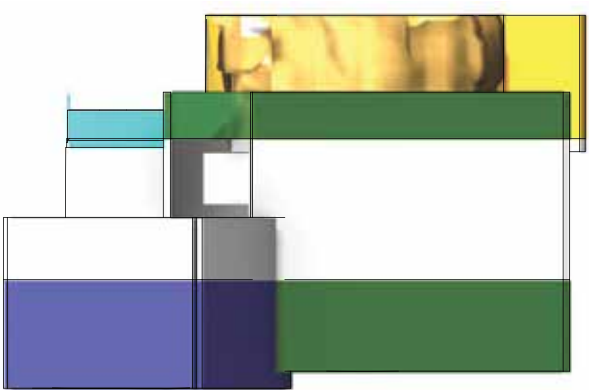
disruption

'Disruption' used contrast to emphasise the tactile and visual qualities designed, whilst making the overall interior less intense, and more functional. This was achieved through taking a large strip of the design and removing all volumetric elements and colour from either within or outside of it. The disruption to the flow of the rest of the room draws attention to the tactile and visual elements, making the move away from the traditional orthogonal process of design more obvious. For this process white was used as the contrast to the colour but black could also be used as it has the ability to heighten colour.

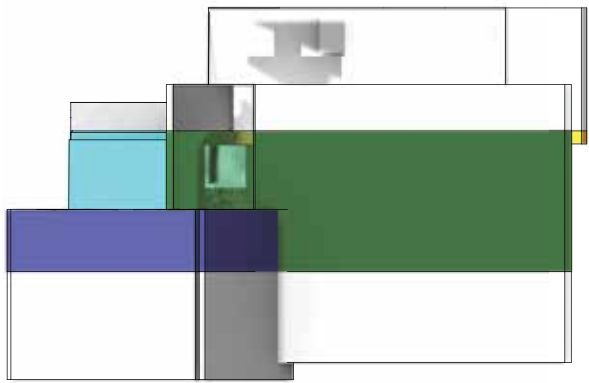
The thinking behind this method of extraction was that orthogonal thinking is a disruption to the creative process whilst creative thinking is a disruption to the standard orthogonal process.

Six initial disruptions were created, then reversed creating a total of twelve iterations. The qualities and effects of each iteration are discussed. Eleven of these iterations were not developed further and were used purely to grasp the atmosphere and forms created, though many of these iterations could provide quite interesting and unique outcomes if developed. One was chosen to refine to demonstrate how the process of 'Disruption' could lead to a successful design of the interior of a small dwelling with a strong influence of the tactile sense.

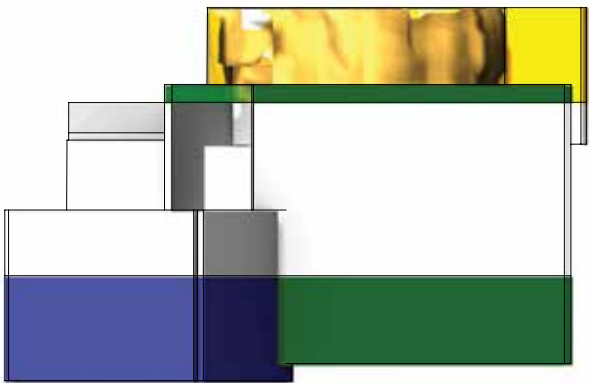
1. A strip of the interior had all colour and tactile qualities removed. This created a strong contrast and emphasised the colours and forms that remained outside the disrupted area. The disruption within this iteration was not dominant enough to create the desired effect.



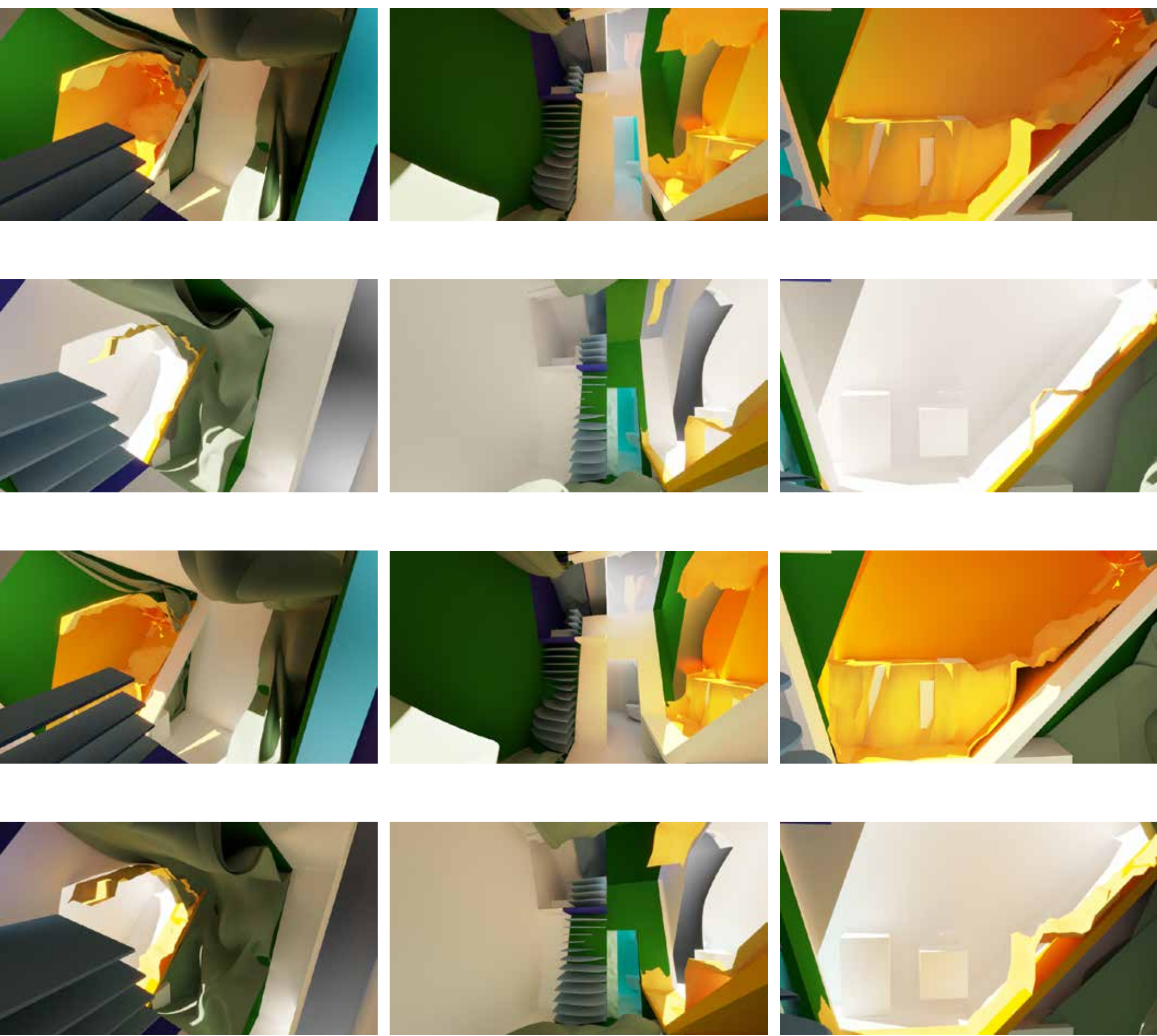
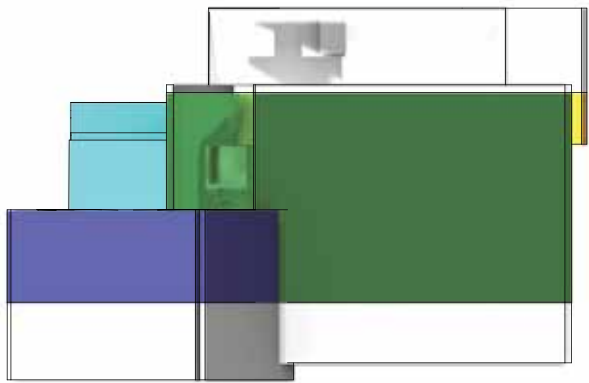
2. The first iteration was reversed so that the colour and polysurfaces became the disruption. This highlighted these elements more however a significant amount of the geometries of the polysurfaces were lost through this. This meant the effect of the form was also lost.



3. Similar to the first iteration but with a thicker stripe, the third iteration used a white, orthogonal disruption to the interior of the small home. This emphasised the contrast between spaces, whilst leaving enough of the forms behind to communicate the desired atmospheric effects.

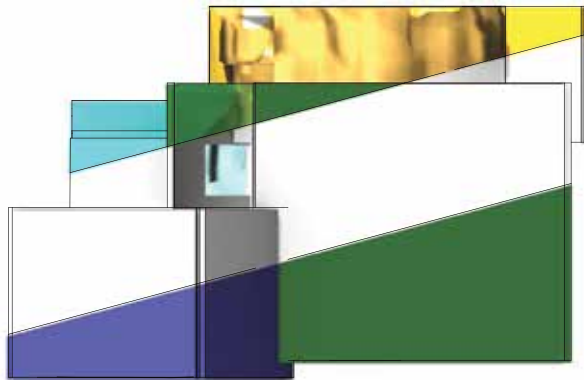


4. Similar to the second iteration but with a larger area of disruption, the polysurfaces become a feature through the centre of the interior. A larger portion of the interior was kept in full saturation which brought the proportion of elements to a more successful ratio, though most of the form and atmosphere of the kitchen was lost.

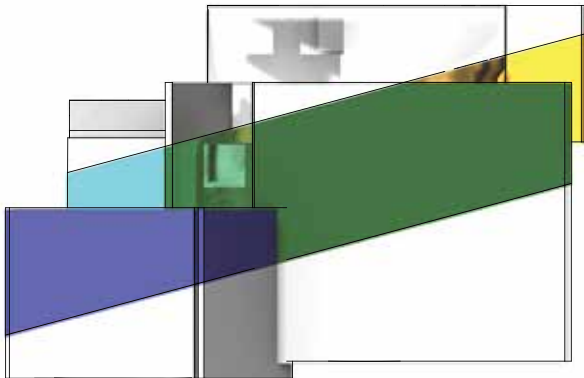




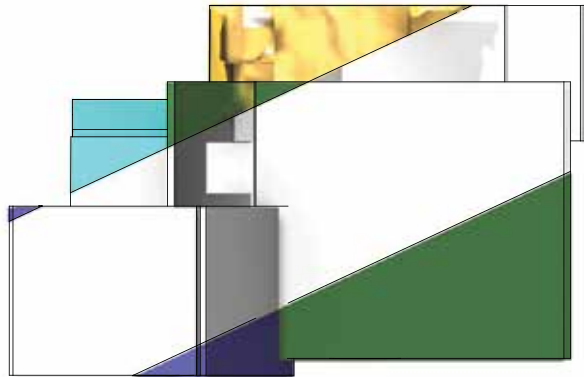
5. The angle of the disrupted area was altered in this iteration. The angle meant that more of each element was kept, while the disruption created an interesting effect with unique shapes and angles. The disruption was too narrow to create enough of a contrast within the interior.



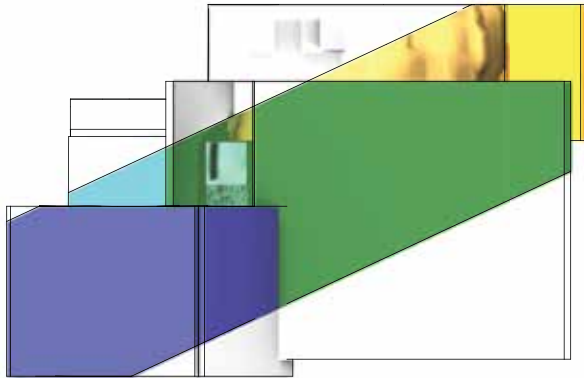
6. Iteration five was reversed to create this iteration. The size of the disruption was slightly too thin for this method though, as a significant amount of the polysurface geometries and therefore the desired atmospheres were lost.



7. Similar to iteration five but with a wider area of disruption, the seventh iteration lost almost all of the polysurface within the bedroom as well as the majority of access to it. This meant that the desired atmosphere within this space was also removed.

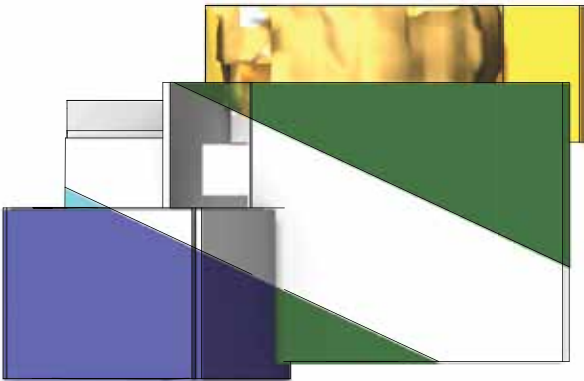


8. This iteration was the exact reverse of iteration seven, with the polysurfaces and colour being the disruption within the interior. While the bedroom and access was retained in this iteration, the majority of the kitchen and living area were lost. There was quite a strong indication of the atmospheres within each space despite this.

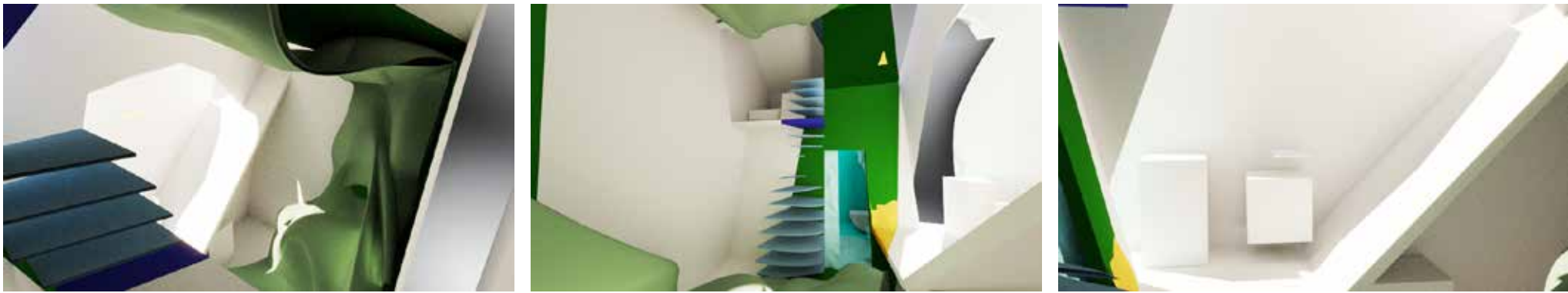
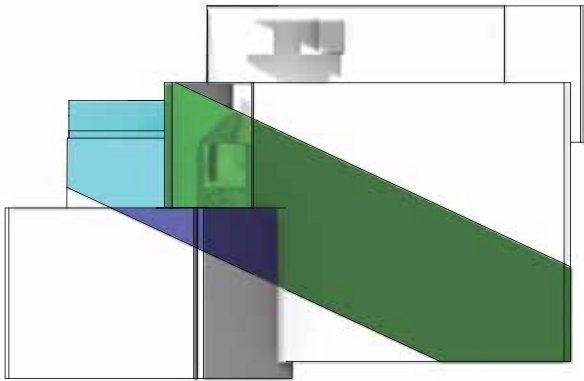




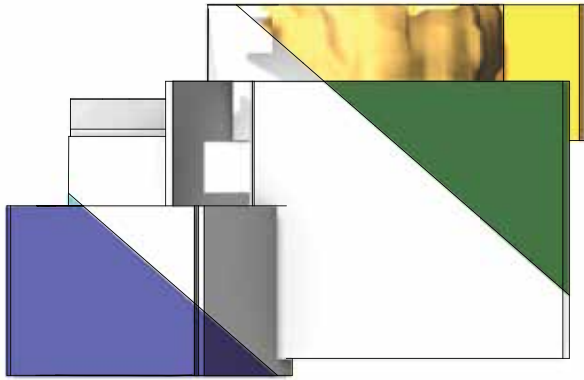
9. Once again placing the disruption at a different angle allowed the atmospheres and forms to be sliced through in different places. A powerful contrast was created between the white orthogonal area and the area of full saturation due to the ratio of area within each of the zones.



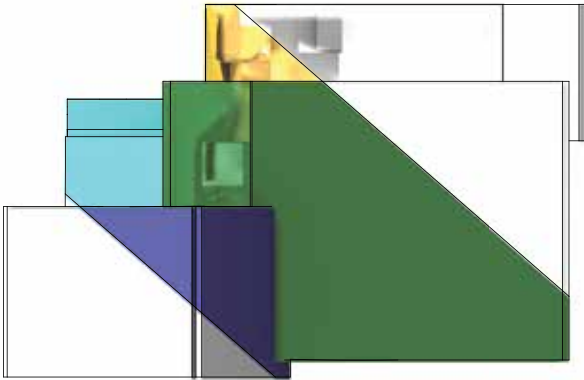
10. The exact reverse of iteration nine, the disruption is the area of full saturation. There is a strong emphasis on the polysurfaces and colour that remain in the interior, however too much of the forms are lost in the bedroom and kitchen to understand the atmosphere within these spaces.



11. Using a wider area of disruption left a very strong emphasis on the colour and polysurface geometries that remained. Almost all forms and colours were lost in this iteration, although because there was such a contrast between them and the space, enough attention was drawn to the areas of full saturation that the atmosphere was still clear.



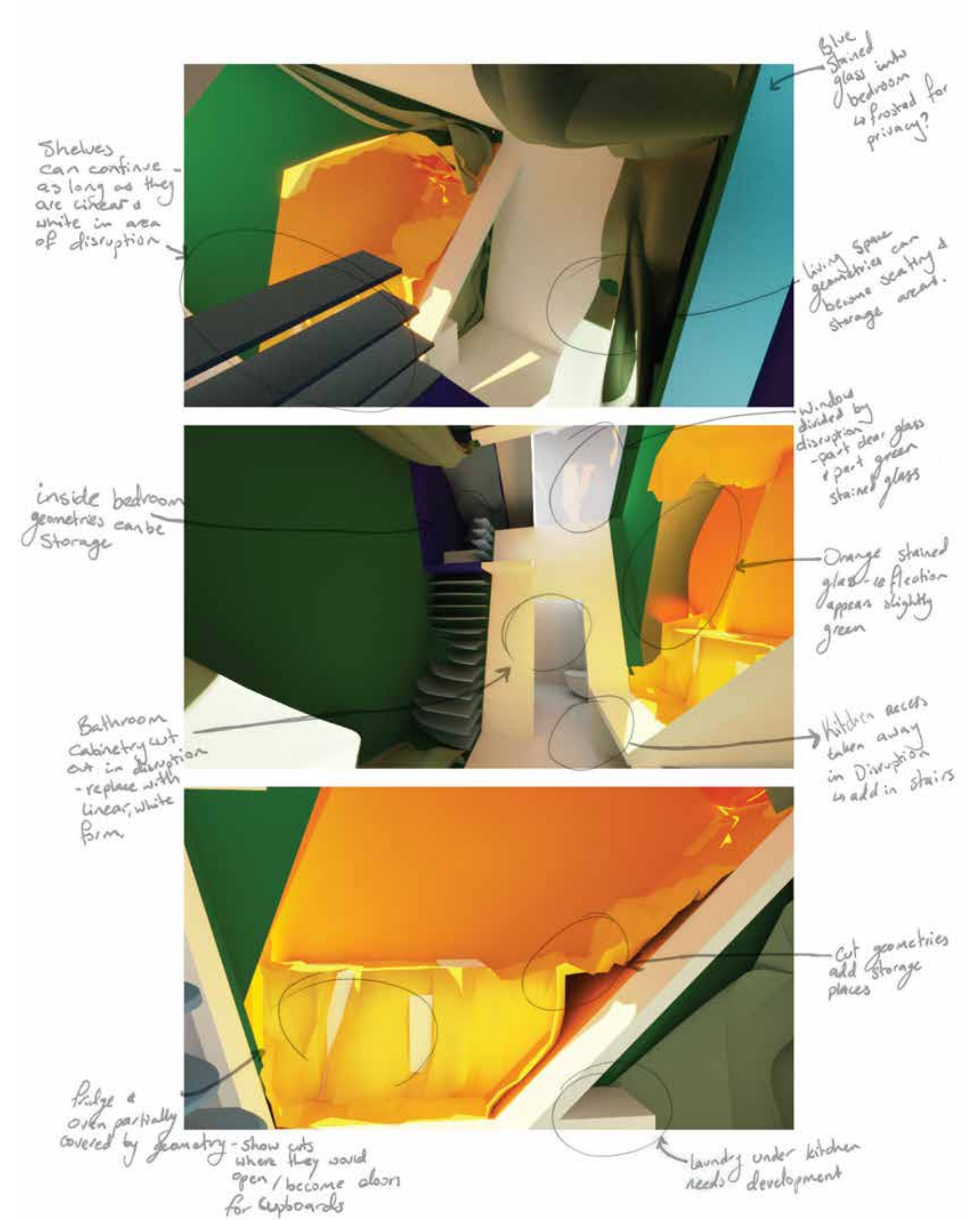
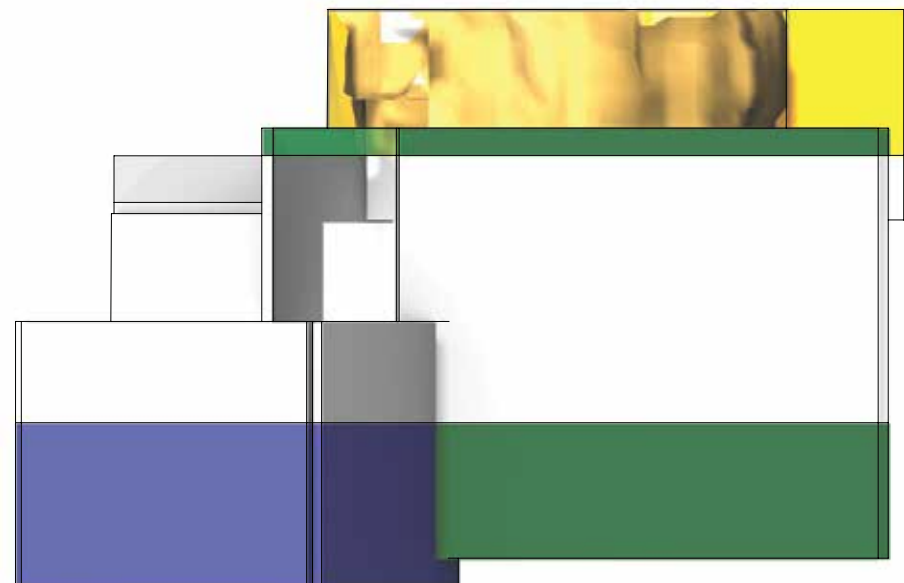
12. The twelfth iteration was the exact reverse of the previous iteration, with the area of full saturation being the intended area of disruption. Because the area of the intended disruption outweighed the white, orthogonal area, the effect of the disruption was lost.





Exploring so many iterations was quite useful as it demonstrated how many different options for Disruption there are. It also made it clear that the ratio between the disrupted area, and the area outside the disruption is crucial. This ratio varies on the angle of the disruption and whether the disruption is full saturation or white orthogonal forms.

Iteration three was chosen for development because there was a large enough contrast to highlight the design well, whilst also maintaining enough of the designed forms to communicate the atmosphere and ideas behind them. It was then analysed to see what needed to be developed and what opportunities were provided by the forms.



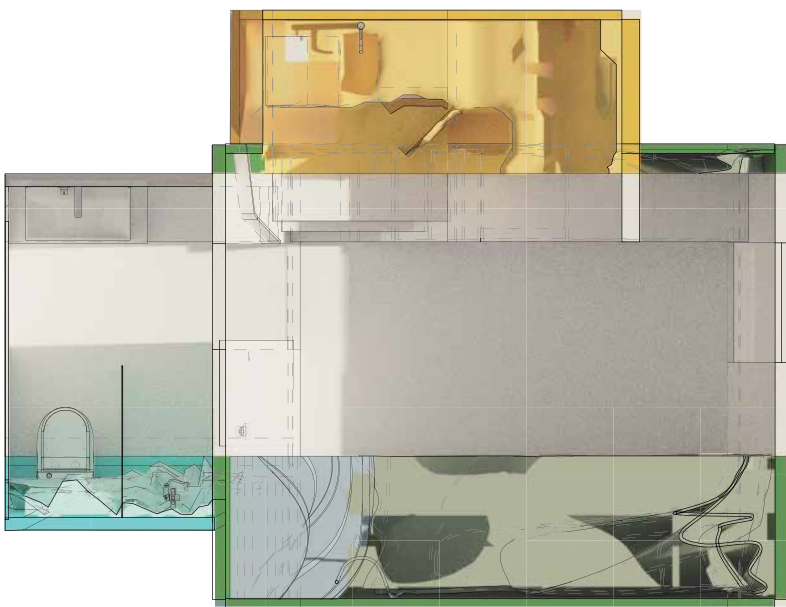


The first step of development was to replace any functional elements lost through the disruption process. This included access to the kitchen, and fixing up the bathroom.

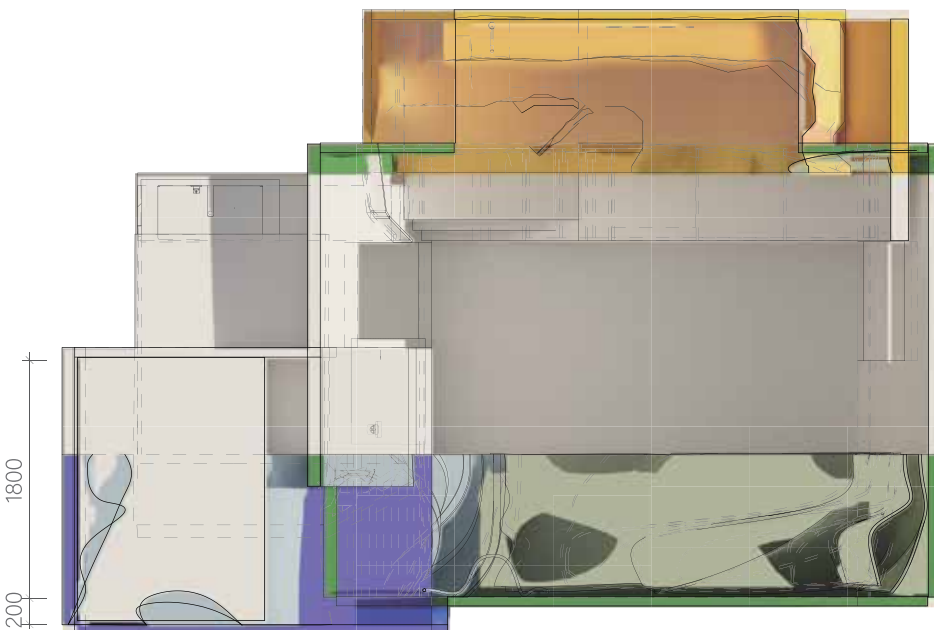
The decision was made to use standard taps and mixers in the kitchen and bathroom for a sense of normality and user-friendliness. This helped to make the space more understandable as people are able to make associations to elements they would already be familiar with.



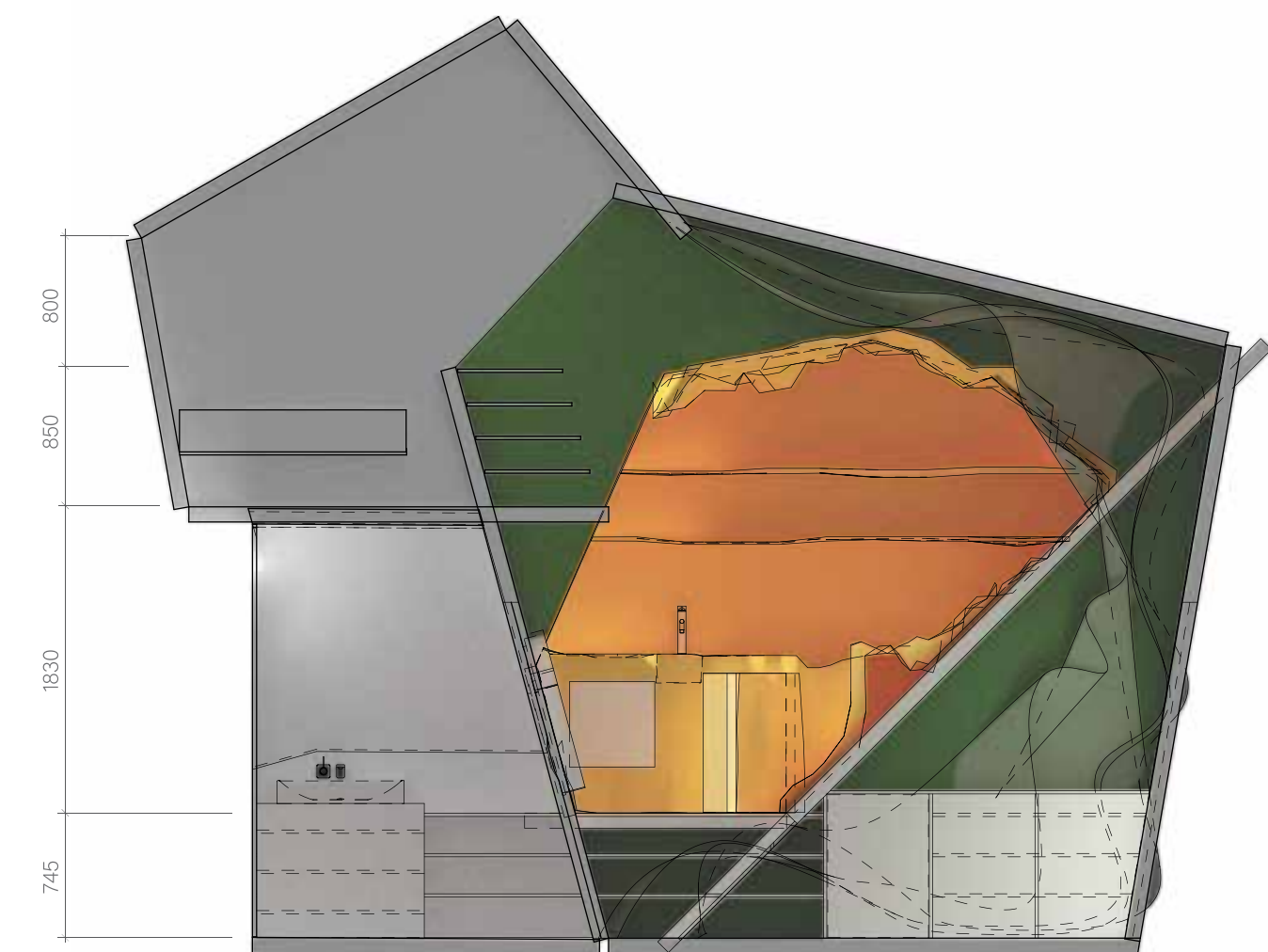
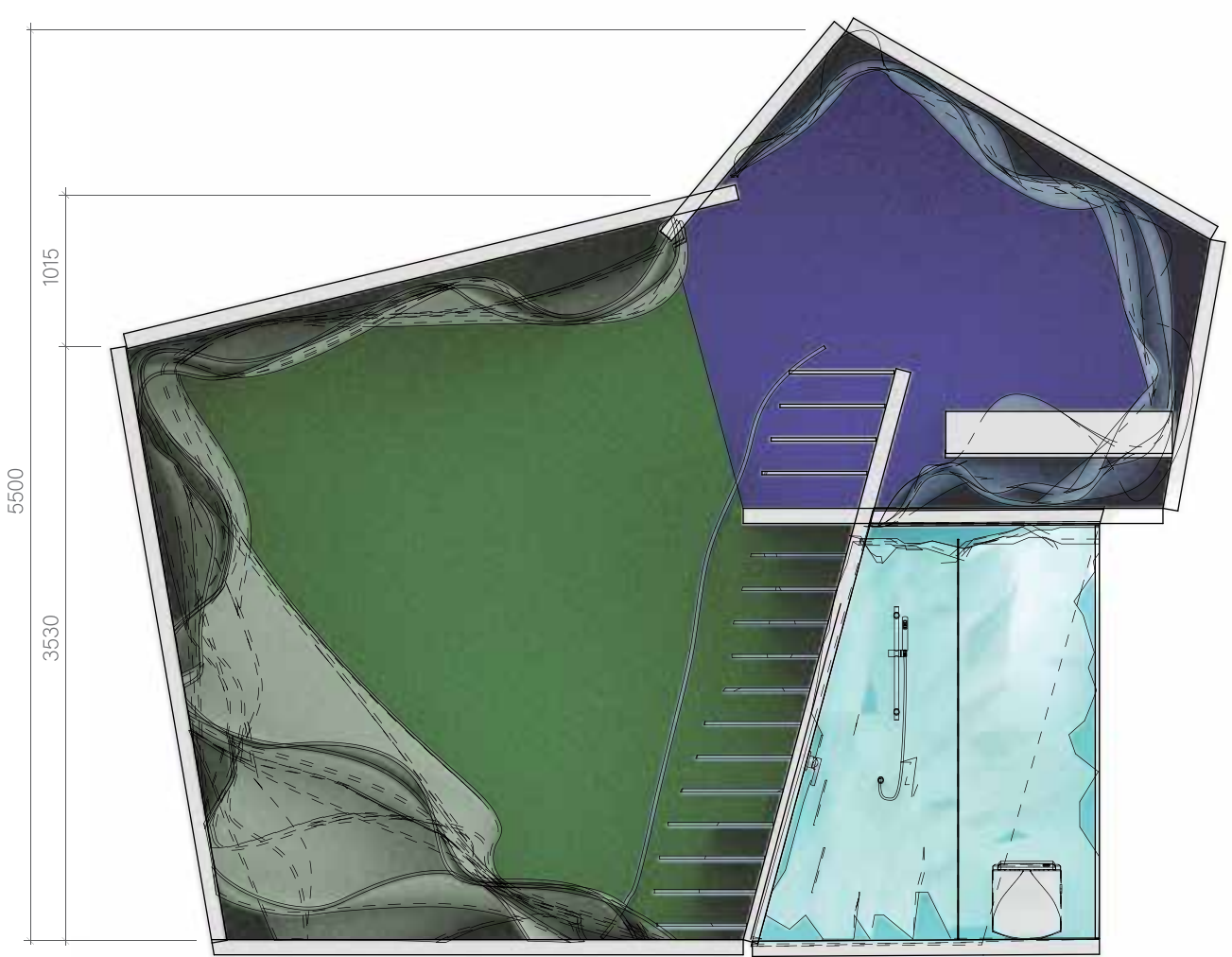
Plan at 1m

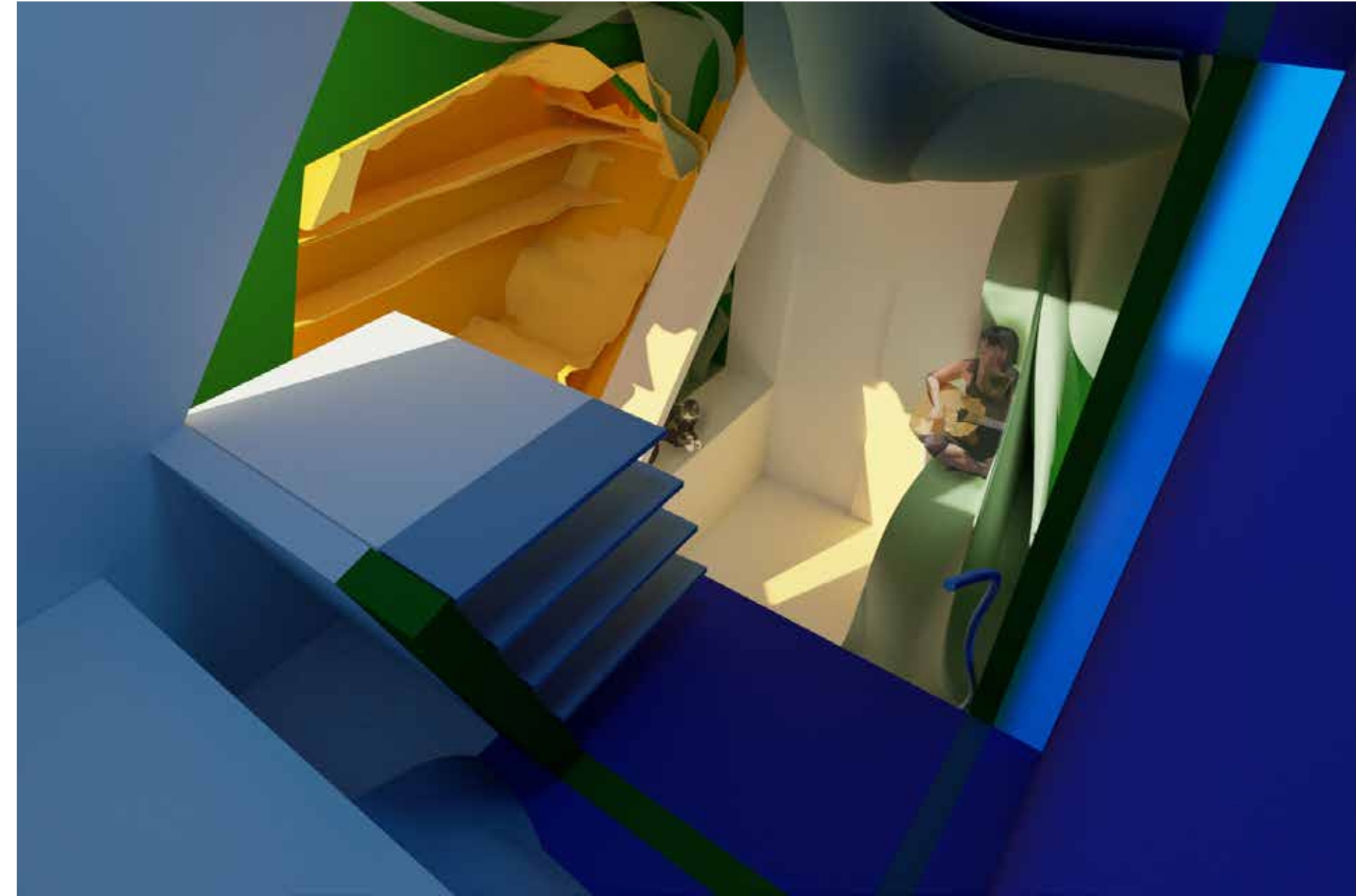


Plan at 2m



Plan at 3m



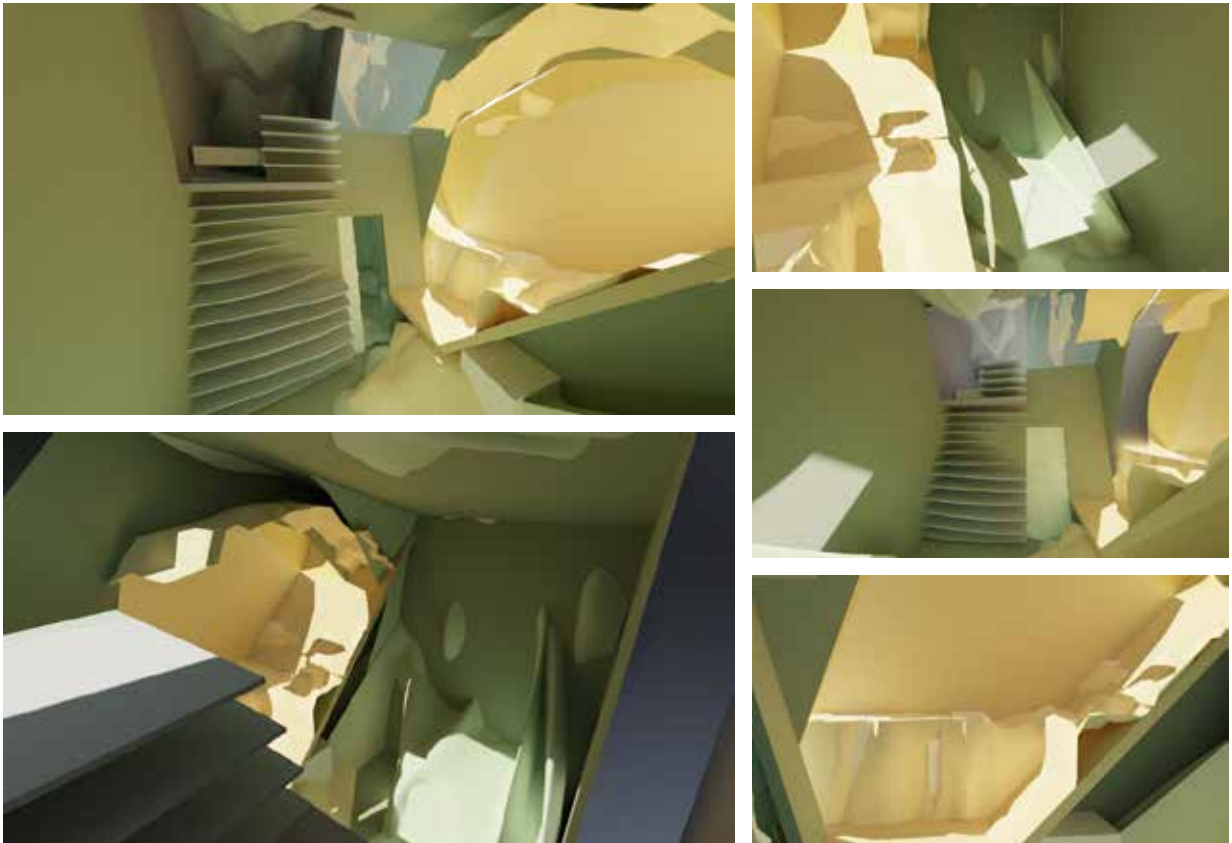




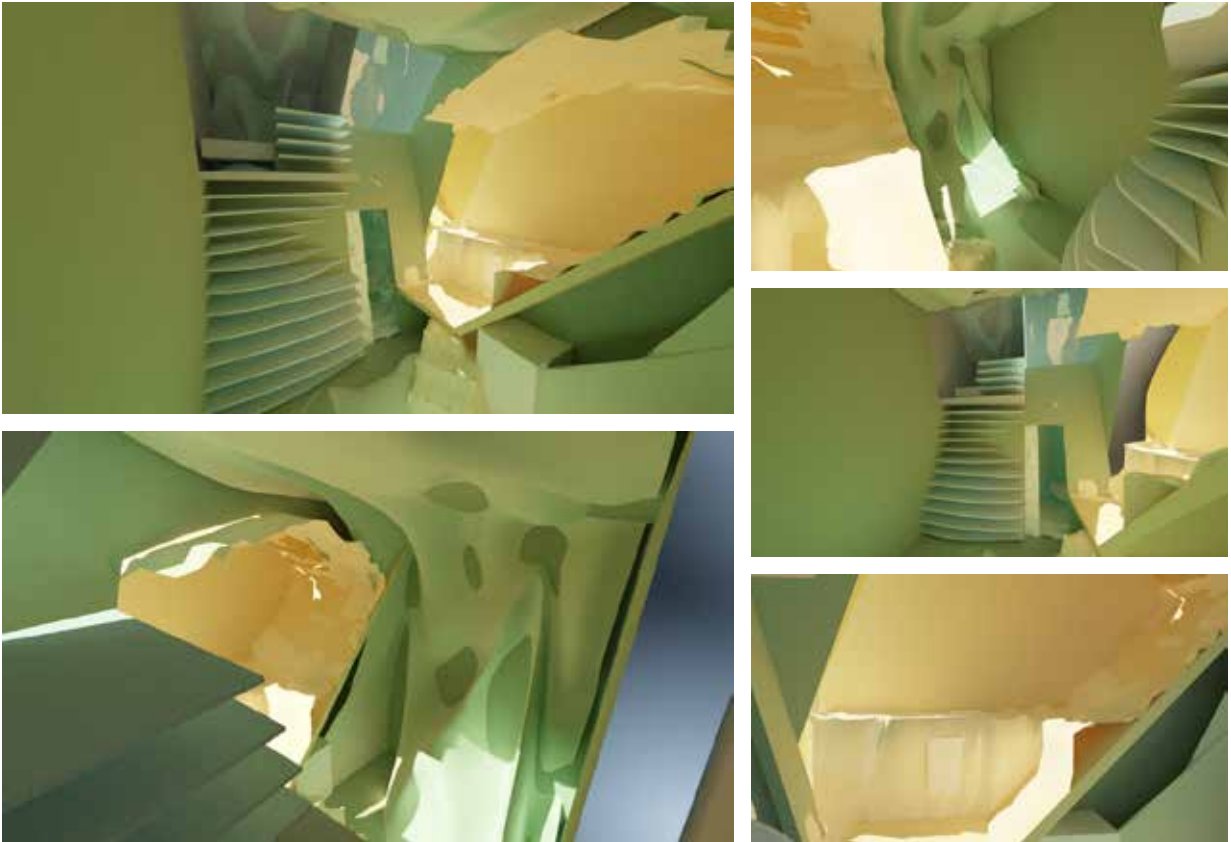
subtlety

There are multiple ways in which the process of 'Subtlety' could be applied. These include expanding all polysurfaces outwards until only their deepest points are distinguishable within the interior; and softening or smoothing all polysurfaces and thresholds until only a slight hint of the original form is left. There are many levels to which this can be pushed and would depend on how obvious or subtle the designer wanted the outcome to be.

Both of these methods of 'Subtlety' were experimented with, providing three iterations. Though this exploration was not as in-depth as 'Disruption' it still gives a good idea of what can be achieved through this method of extraction. The third iteration was chosen to develop further to demonstrate how the extraction process of 'Subtlety' could lead to a successful design of the interior of a small dwelling with a strong influence of the tactile sense.



Expanding all polysurfaces outwards and slightly smoothing certain elements, as well as reducing the saturation of the colours changed the spaces significantly. The contrast of the colours and shapes was decreased considerably but still gave hints of the initial design elements.



Softening and smoothing the geometries of the polysurfaces, as well as reducing the saturation of the colours left some interesting spaces and geometries whilst making the space more user-friendly.



This process was repeated to the already softened design to have an even more subtle touch of the tactile design process.

The third iteration of 'Subtlety' was chosen to develop further because it was the iteration in which the forms were reduced the furthest. It was analysed to see what needed to be developed and what opportunities were provided through the polysurfaces and geometries of the spaces.

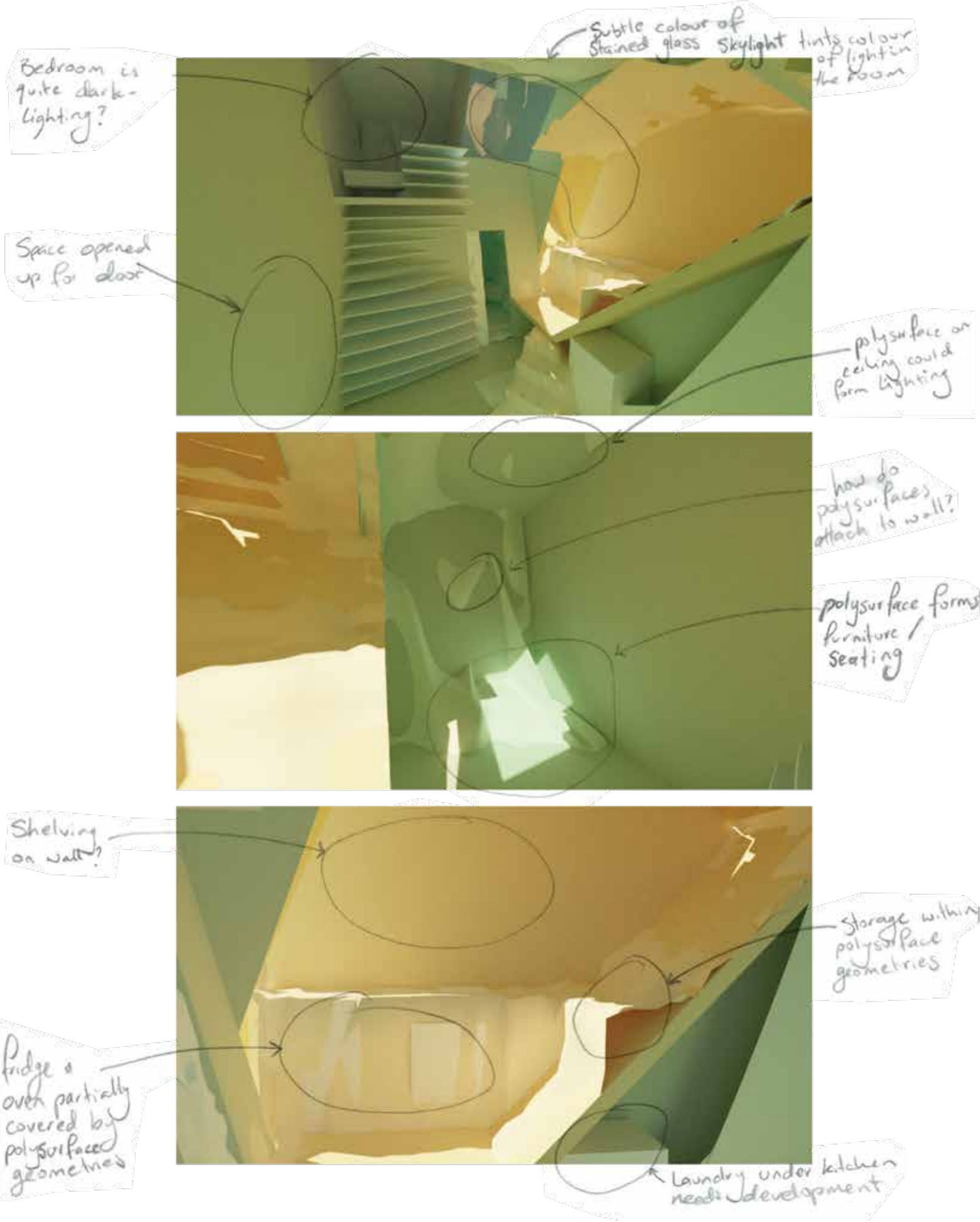
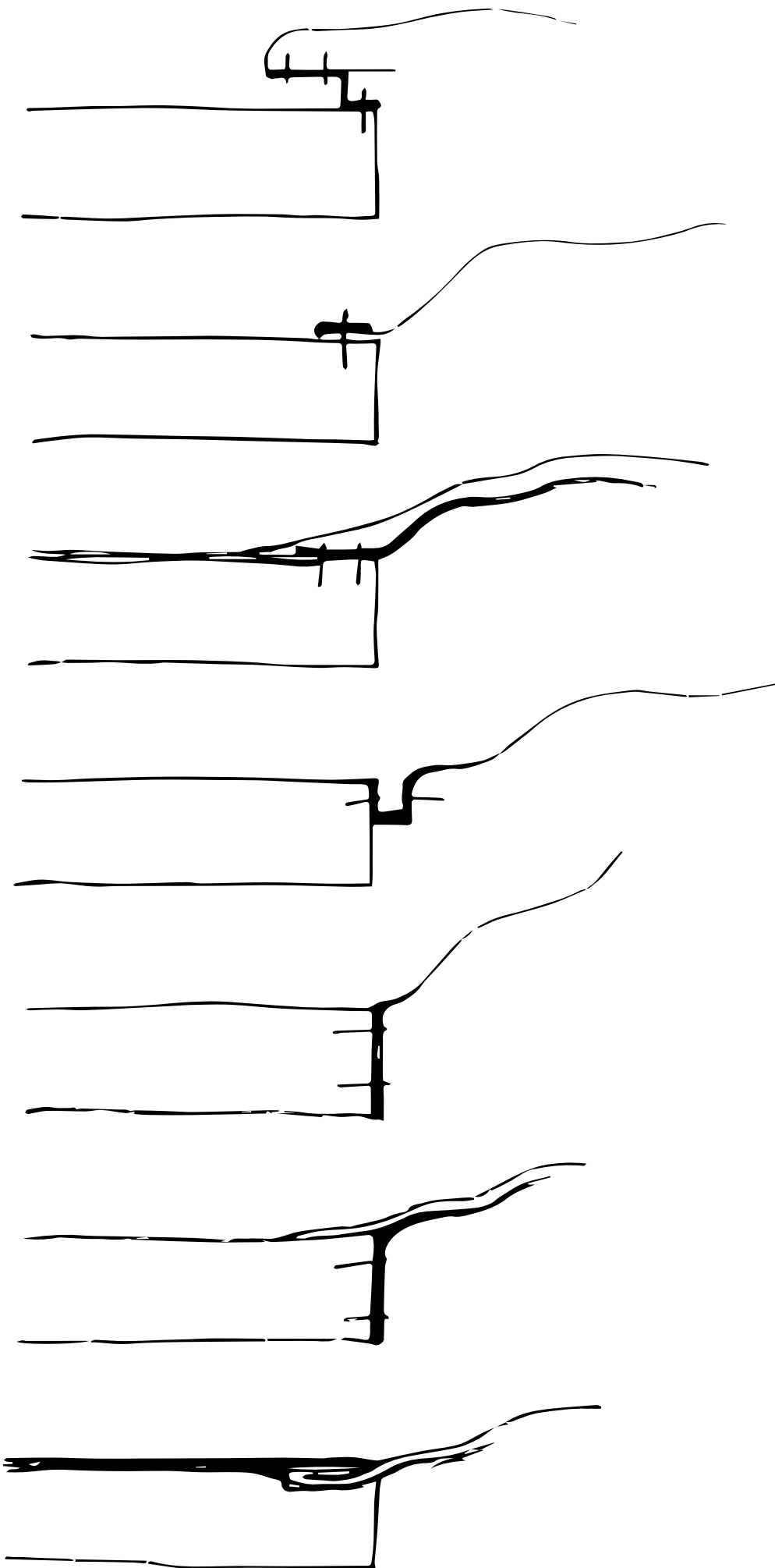


Figure.266





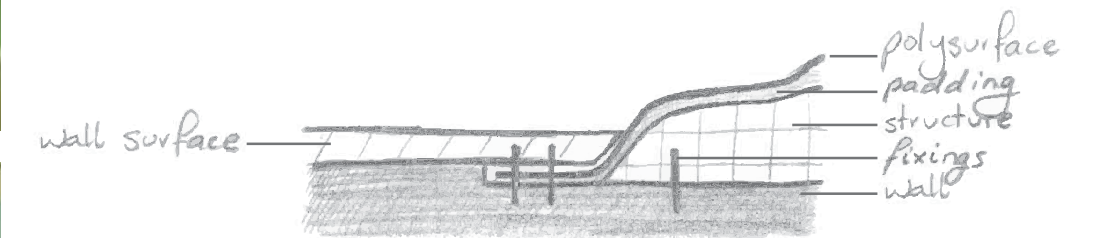
The first step of development for 'Subtlety' was exploring the connection between the polysurfaces and the wall. These were kept at a conceptual level but were an important consideration for this stage of design. The soft and malleable surfaces of the bedroom and living area were used as the starting point for this process.

There were many ideas for how the transition between surfaces would be made - from highly noticeable, to a completely hidden join. The difference between each texture was more noticeable when the fabrics were directly adjacent, and the move between them a lot smoother. For these reasons a smooth transition with a hidden join was chosen.

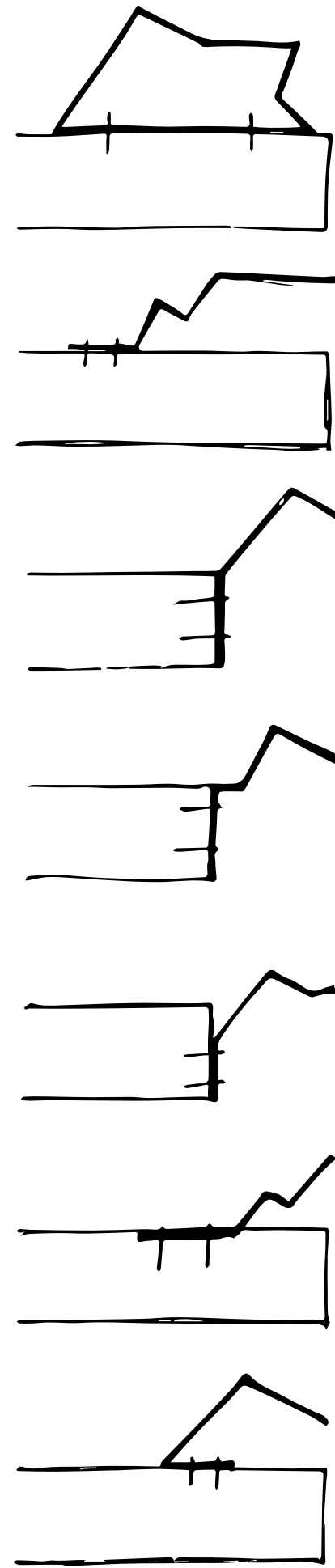
## Atmosphere



## Materials



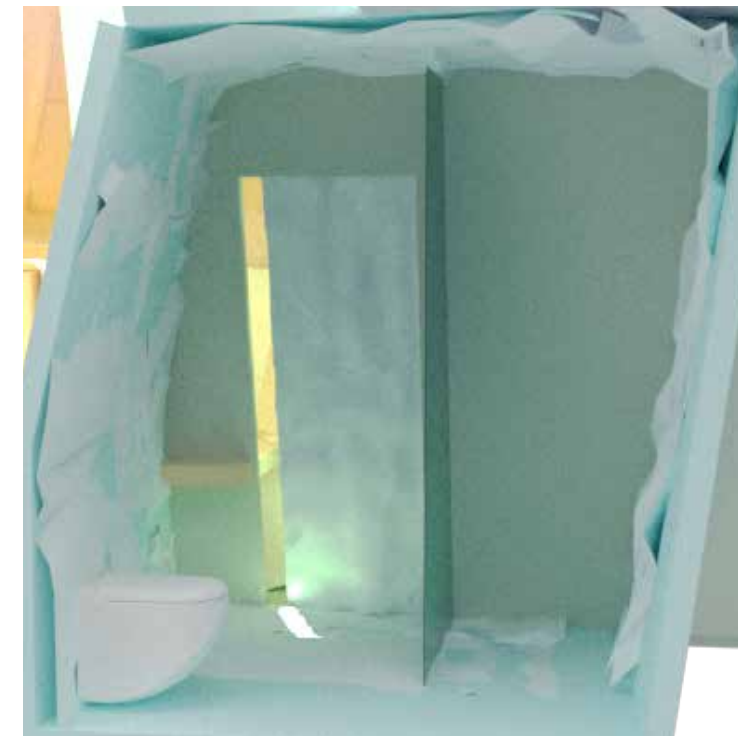
Bedroom/living area polysurface connection



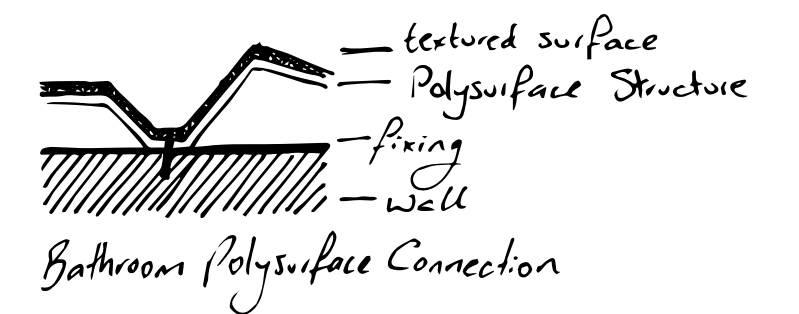
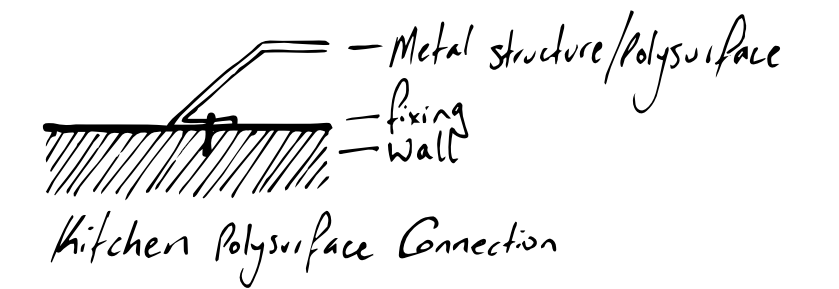
The bathroom and kitchen utilised a different type of geometries, and so would need a different type of connection between polysurface and wall. Again looking at whether an exposed or hidden join was right for this element, the more solid structures provided many opportunities. To stay coordinated with the other areas, a hidden join was chosen. Unlike the bedroom and living area, the tactile surface materials of the bathroom and kitchen were different enough to require slight variations in their structure.

The tactile polysurface in the kitchen was a thin bent metal meaning it could attach directly to the wall with limited fixings. The bathroom polysurface would have been slightly heavier, meaning more frequent fixings would be required.

*Atmosphere*

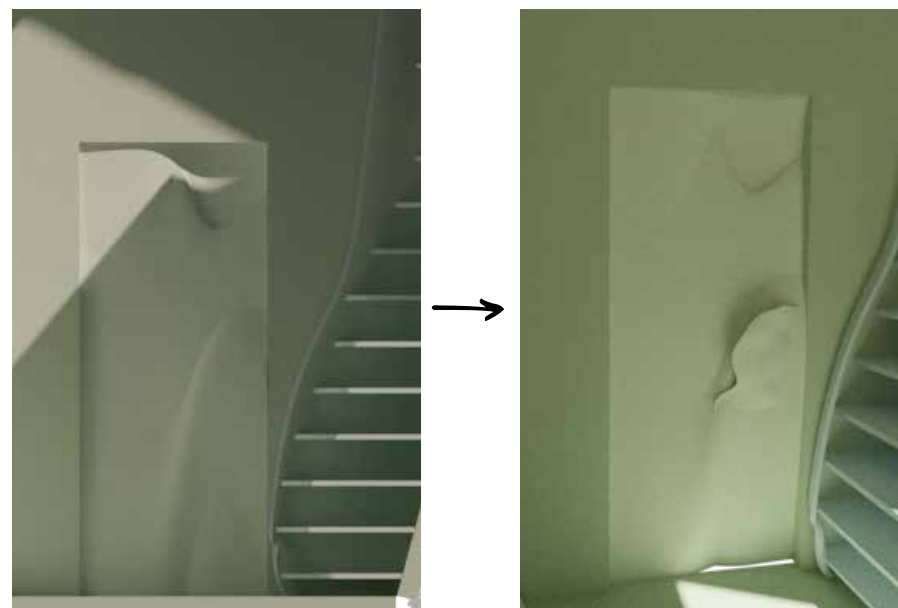
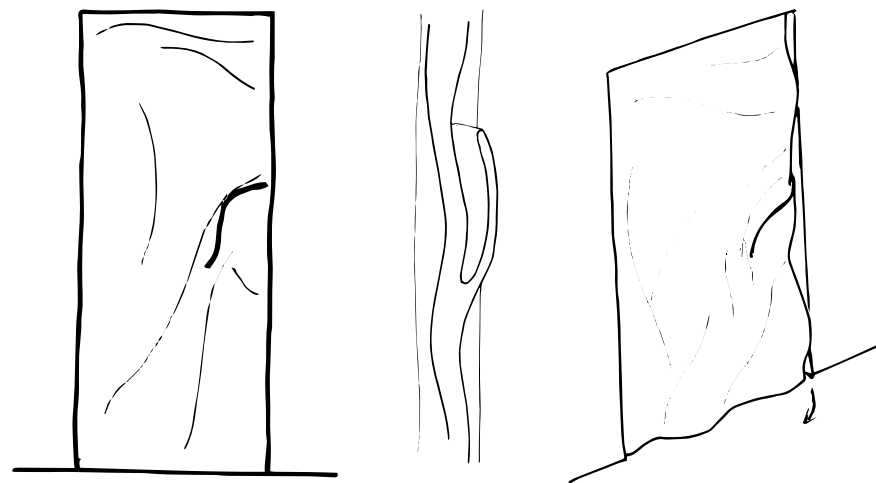


*Materials*



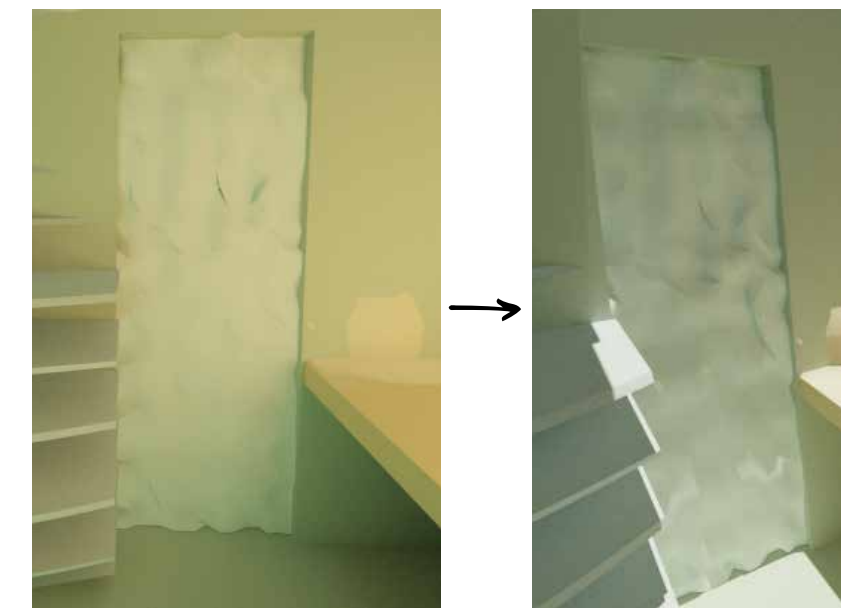
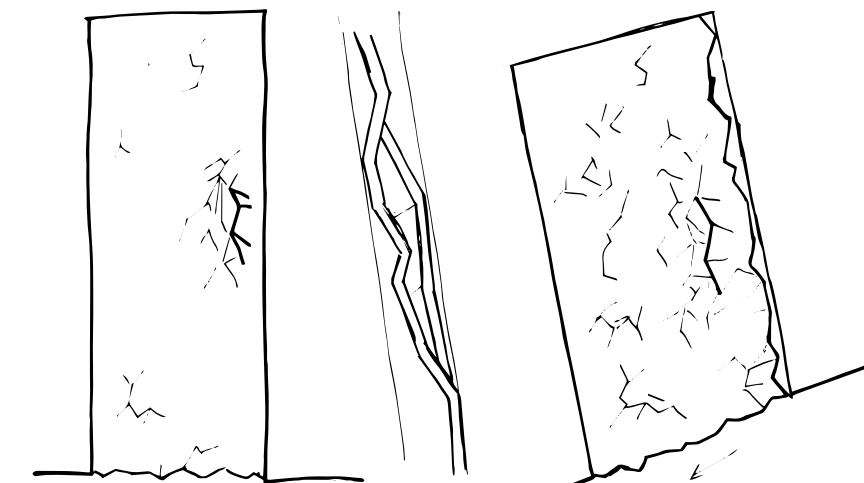


Front Door / Main House Access



The main access into the home is directly into the living area. The door is a tactile element utilising the same structure and texture as the polysurfaces of the living area.

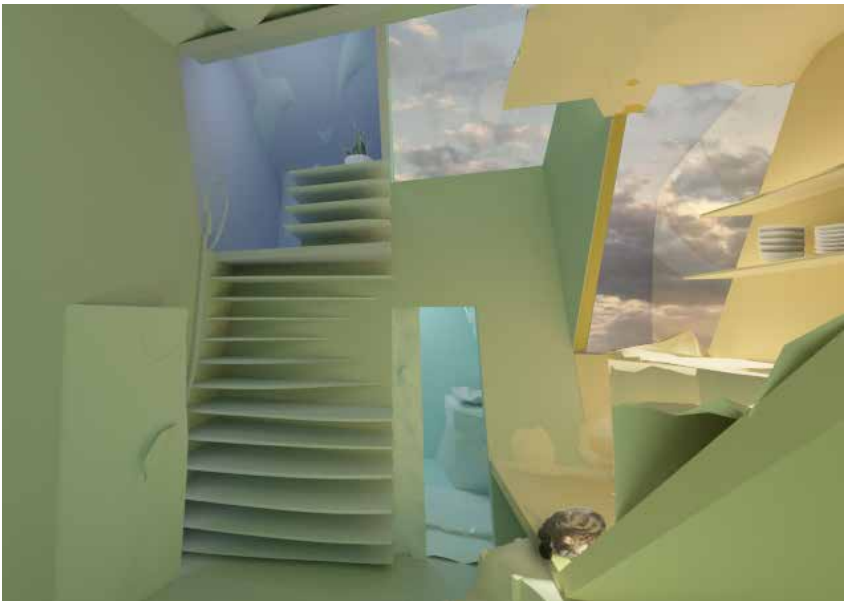
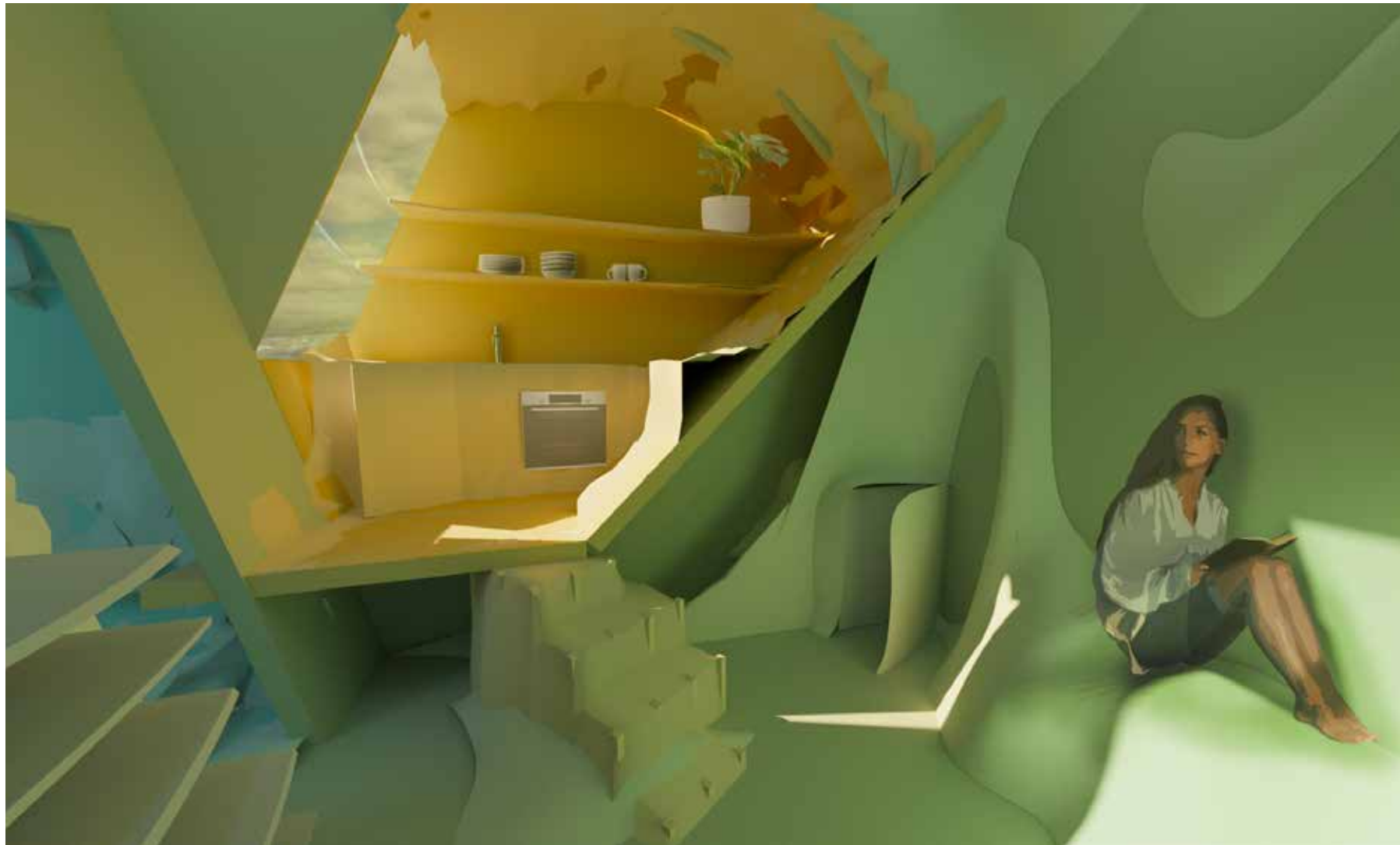
Bathroom Door



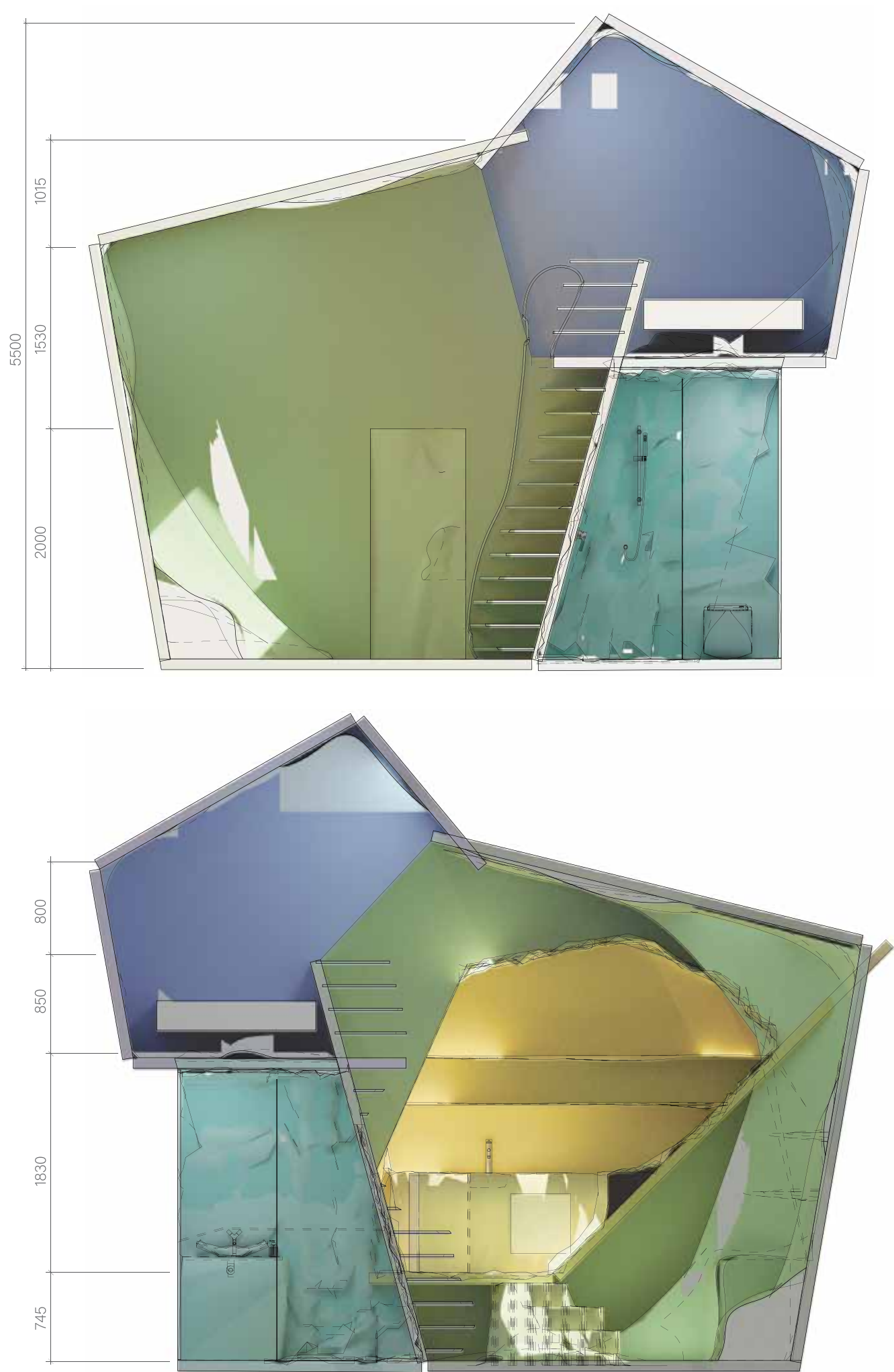
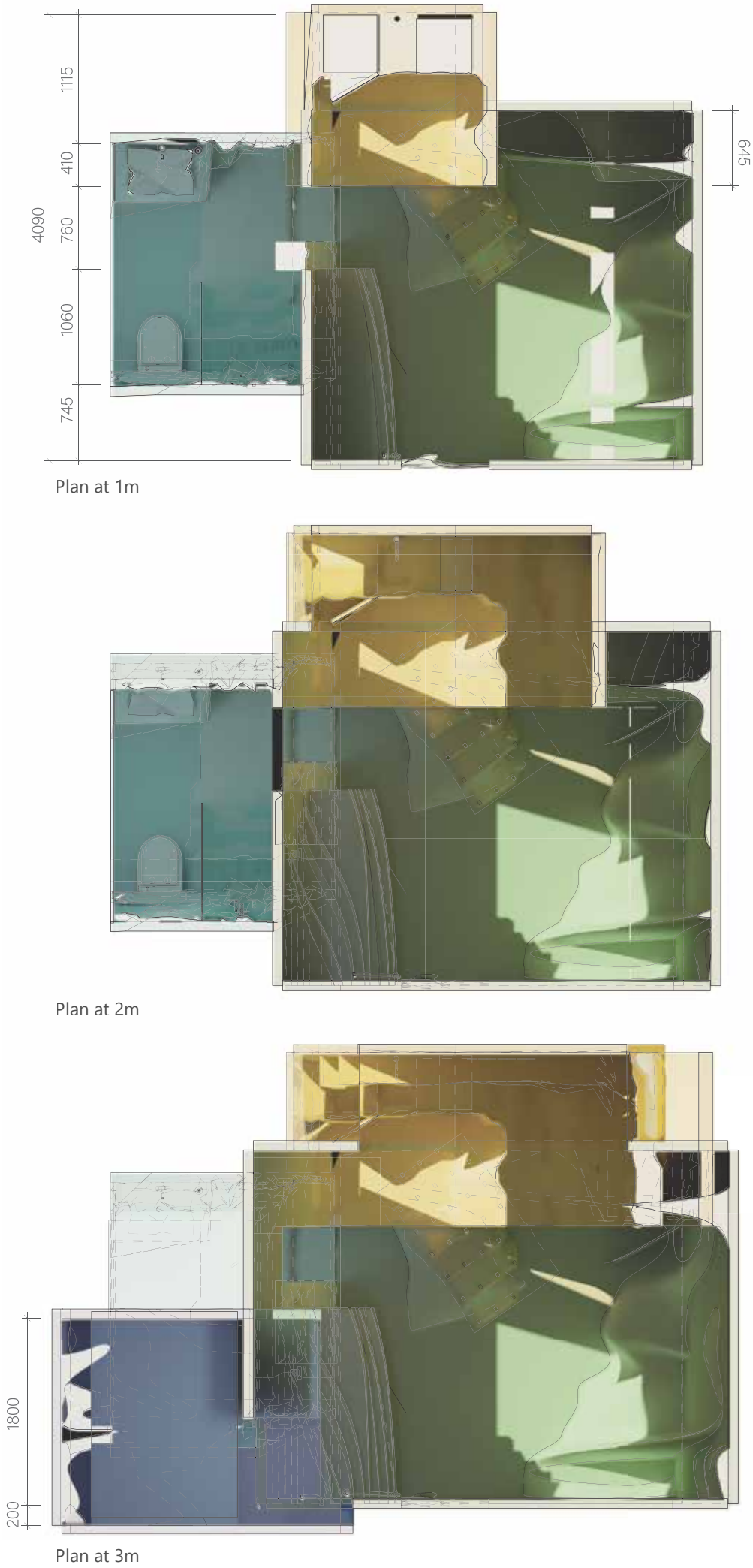
The sliding door to the bathroom is a tactile threshold. It consists of the same tactile surface as the bathroom polysurfaces to indicate the boundary between spaces.

The final step of the development process was to refine or replace any functional elements that were missing. This included adding hardware such as taps, and fixing any layout issues that resulted from this.

As with 'Disruption', the decision was made to use standard taps and mixers in the kitchen and bathroom for a sense of normality and user-friendliness.

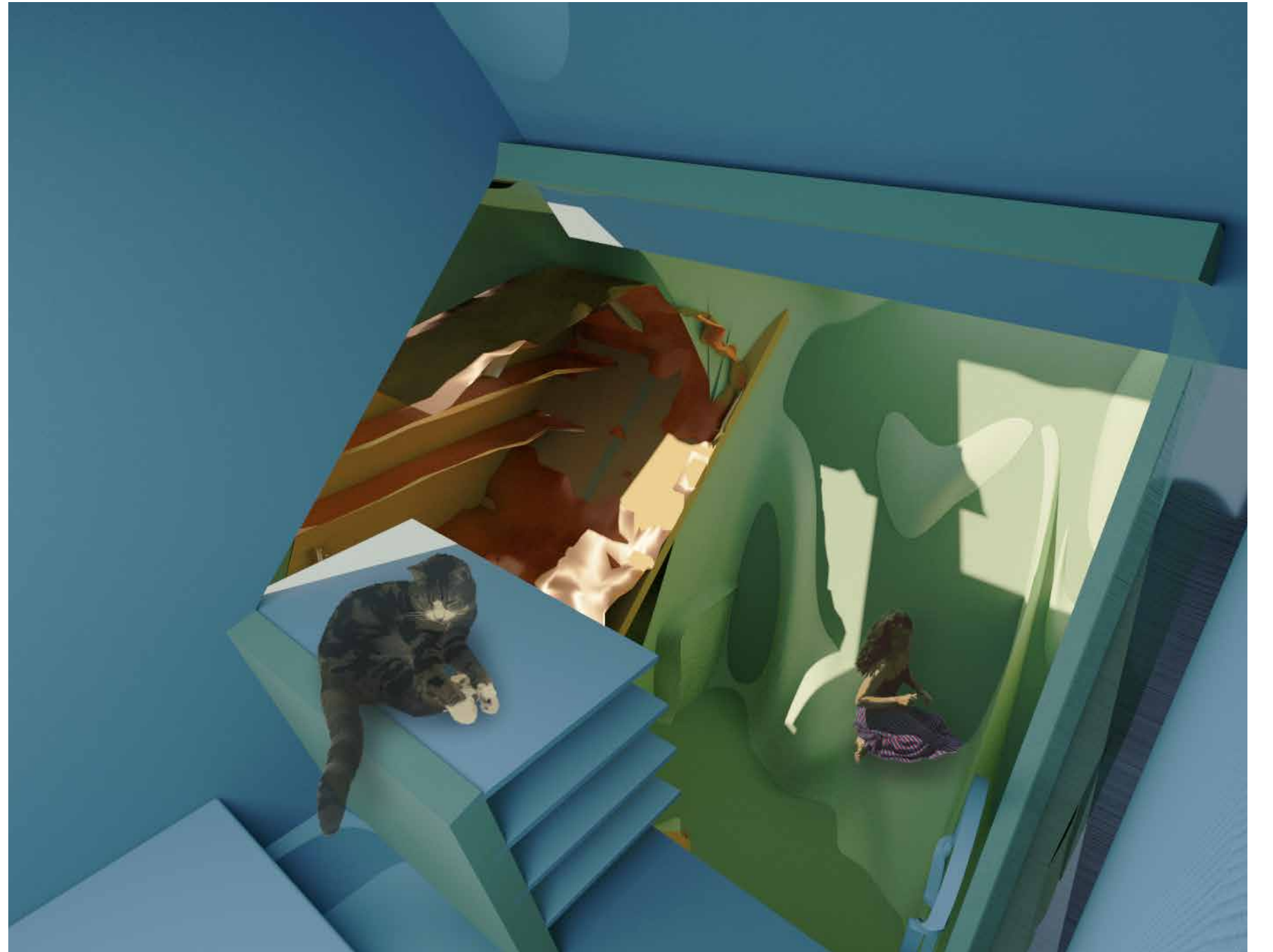
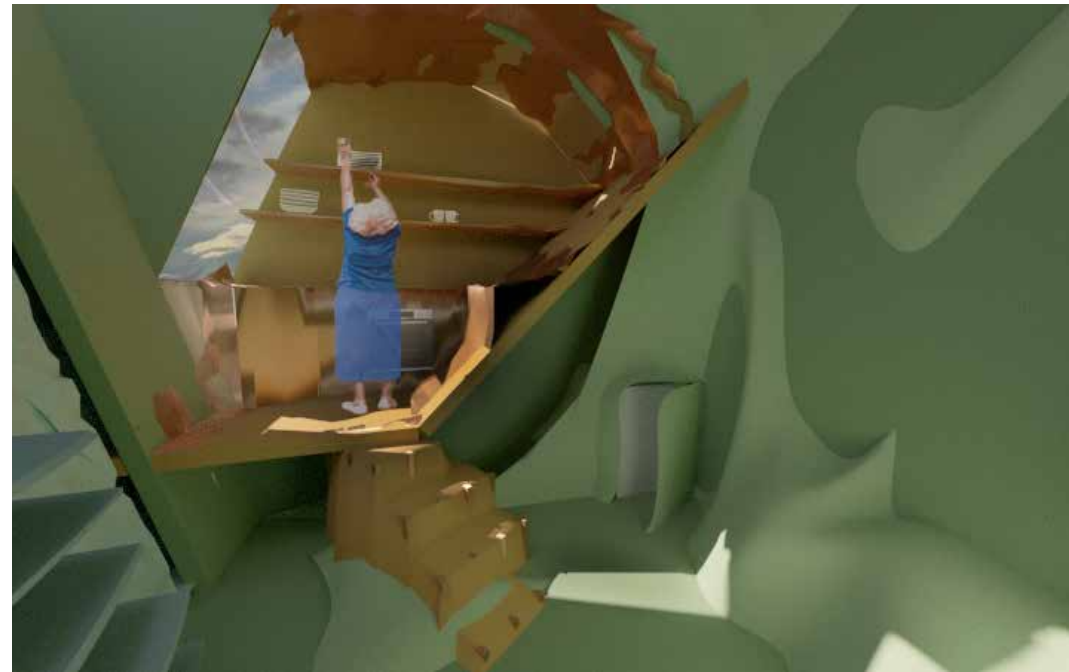








The previous explorations into materials were applied into the digital model. This altered colours and surface appearances slightly.







## Key Findings from Chapter 5

The framework was applied to create a design of the interior of a small house. There were multiple routes that could be taken and the final stage had multiple methods of refinement, however, touch was always a key factor and central to any design decisions being made.

There were a few issues that arose during the testing process. These are discussed and analysed more in depth within the next chapter. From there the framework is revised and reworked so that it flows smoother and to prevent certain elements from getting neglected.

The designs themselves could have been developed further but for the purpose of testing the framework the level of development was deemed sufficient to showcase this stage of the process. The overall atmosphere and the finer details were touched upon between the two methods of extraction that were explored. These would each develop further depending on the needs and wants of the intended occupant of the space. Although buildability was considered throughout the process and New Zealand regulations were observed for the most part, much of the design work is purely conceptual and hypothetical. Structural engineering would need to be further considered.

# CHAPTER 6

## CONCLUSIONS & REFLECTIONS

### CRITIQUE OF FRAMEWORK & DESIGN PROCESS

This chapter begins with a critique of the framework. By testing the framework through the design of a small house interior, issues to be reviewed and fixed arose. Each stage is discussed separately, with overall reflections on the process after. This provides the opportunity to refine the framework for a better flow and to assess the entire research process to finally evaluate how well the initial goal was met.



# Framework Reflection

## Stage 1 Reflections:

The first stage was quite a quick process, inspired by the KODA model. It is the easiest place to alter volumes,their locations and relationships, their functions and the general criteria of the design to fit into a different volume or shape. The location for primary access into the home was not included in the framework so it ended up being neglected until stage five. To avoid this, it should be established at this stage.

## Stage 2 Reflections:

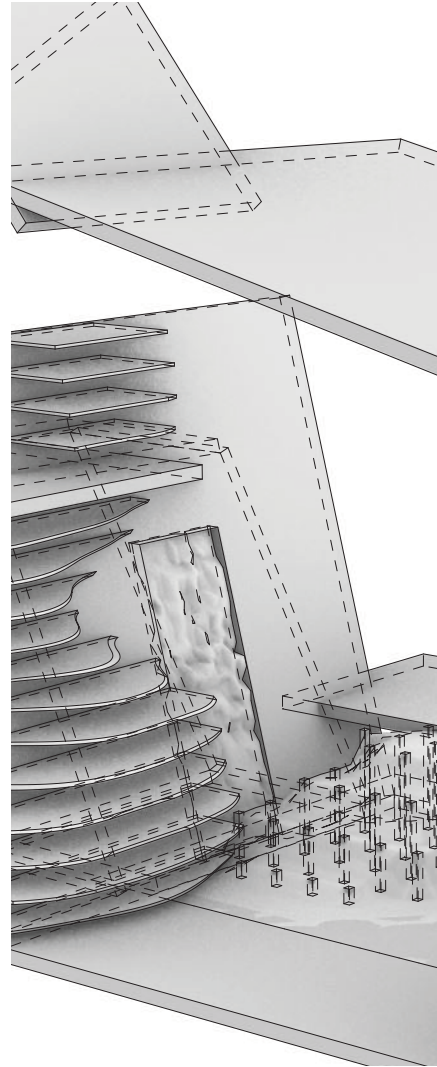
In contrast to the first stage, stage two was a very lengthy process involving multiple models. It relied heavily on physical and tactile methods in the beginning, before moving into the digital realm. The initial set of models worked within an orthogonal representation of each volume established in stage one. Some interesting forms were created through this set, which used paper to create organic and tessellated surfaces depending on the function of the space. The thought process behind the use of paper to create the forms was drawn forward from experimentation earlier in the research.

A new set of models was explored in order to further challenge the orthogonal form, while combining all volumes into one overall space. The key ideas brought through were to challenge the orthogonal in both the vertical and horizontal planes,to bring the ideas of contrasting primary and secondary spaces, and to explore how tactile elements can start creating form and structure which influence how people utilise space. This set of models begins to touch on the concept of threshold through the composition of volumes and their relationships to each other before moving back into focusing on the surfaces of the rooms individually. As threshold is primarily looked at in the third stage this meant moving back and forth between stages a few times. To critique the process, this back and forth between stages would be less necessary if the volumes and their composition were fully established and physically modelled in stage one. This would also shorten the overall process of stage two as the need for numerous sets of exploratory models would be less likely.

The third step of stage two was to move into digital modelling. Though it was not discussed in the framework itself, it was seen as a necessary step to continue moving the design forward. This allowed the design to be given more set dimensions and scale and made it easier to progress things in further design stages. The digital model was informed entirely by the forms created within the physical models. The decision was made to focus on the thresholds while the general design remains vague and conceptual because thresholds would potentially have a strong influence on the decision of surfaces within each space.



Figure.280



#### Stage 3 Reflections:

Stage three focused on the thresholds between spaces and how the occupants of the home would move between each room. This process was very intuitive and relied on both analogue and digital elements. Beginning by drawing over the last physical model from stage two, certain elements within the overall volume and individual spaces were noticed to either require more work, or large alterations. It also created more elements within the overall space that needed to be designed in more detail. After this initial spatial analysis each threshold was looked at separately.

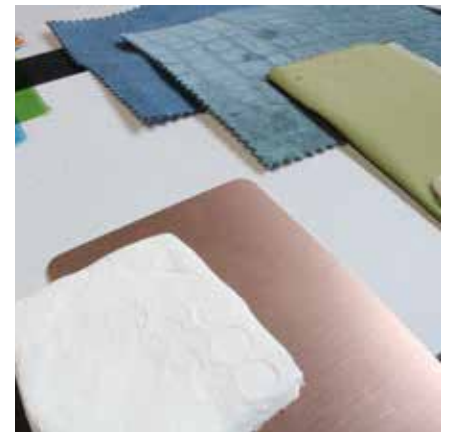
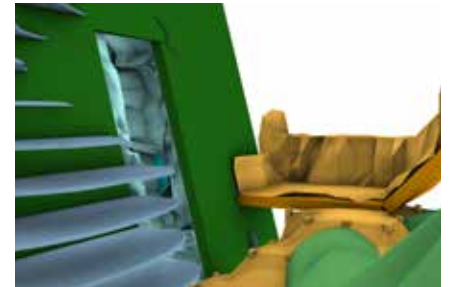
Sketch drawings and physical models were a good starting point for methods in which to move from one space to another, though it quickly became apparent that for design development to occur dimension and scale needed to be set and altered slightly. This was due to practicalities, and ease of design development in later stages. New Zealand standards were looked into when it came to deciding heights of certain elements but were mostly kept as a minor consideration so that the design ideas were not limited by them. While in theory this made sense, it did cause issues further down the line and extended the time spent on other design stages. Consideration of standards should be more crucial in this stage of the design.

As with stage two, the analogue drawings and models were inspired by models and previous findings from the research. These were then translated as closely as possible into the digital model to create the thresholds within the overall volume. This helped with sizing and scale, as well as locating them each in relation to each other. Some elements of the threshold designs were not necessarily functional so these would have to be edited down. The editing process was set aside for stage five. This decision was made because materiality is set in the fourth stage which would likely alter the structure and therefore the form of certain threshold elements.

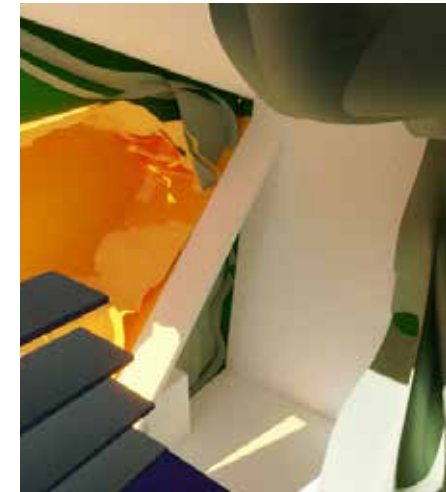
#### Stage 4 Reflections:

Stage four was about light, colour, and materiality. The small house interior by this stage was very intense with polysurfaces and threshold elements, so lighting, colour, and texture would help to separate space and emphasise the forms. This stage was again very intuitive and often flipped between analogue and digital processes. This was partially due to a gap between the knowledge-base of the digital program and the techniques that were being applied. With more knowledge of the program, this could potentially have been navigated better and pushed further, as the accuracy of the lighting qualities was questionable in some instances. Experimenting with physical models was prioritised because of this, and most of the lighting qualities remained somewhat undeveloped. These definitely could have been pushed further as they ended up being somewhat neglected in later stages of design development. Making sure that all lighting elements have at least basic specifications outlined before moving on should be established in the framework.

Choice of materials was limited to what was available locally as samples as it was very important to be able to touch a physical piece of the material. This did limit options, however with so much on the market it was actually beneficial in narrowing down the scope.







#### Stage 5 Reflections:

The design of the small home was refined and developed in this fifth stage of the framework. By this phase of design the interior was completely oversaturated with tactile and visual elements and was effectively an unusable space. Stage five was therefore crucial in making the home both functional and aesthetic.

There were many methods in which to refine the design, each producing a different and unique outcome. As the design of this small home was carried out for the purpose of testing the framework, two different methods were applied and developed to varying levels of detail.

The method of 'Disruption' developed the overall atmosphere within the space, as well as making it more functional.

The method of 'Subtlety' developed finer details such as connections between the polysurface and wall, methods of lighting, and tactile door-handles, as well as the overall atmosphere and functionality of the space.

The method of extraction chosen when applying this framework would depend on external factors such as the wants and needs of the specific client, the forms created by the design during the first four stages, and the predilection of the designer.

Certain elements of the design and of earlier models ended up being neglected somewhat through the digitisation process. This caused setbacks during the design development of the interior. During this primarily digital stage, some components were not reintroduced. In reflection, to avoid this happening earlier stages should be refined, and the physical modelling aspect should be brought back in as the final step of the framework. This would ensure all elements are carried through to completion.



#### Overall Framework Reflections:

Testing the framework through design resulted in a few notes on what worked and on what could be improved.

This design-led research was a very lengthy process with a lot of stages to go through. One could argue that the result of the framework is a very unique and interesting design outcome that would not have been produced using other, more traditional methods.

It is important to note that the entire process was strongly based on the designer's intuitive approach that led to specific choices. Because of this, the framework does not dictate the form or details of the design; only that it is designed through tactile methods, and that the sense of touch is embedded in every aspect of the design. This, along with the fact that no two tactile models will be identical, means that every time this framework is used, an entirely different outcome will occur.

Throughout the process most legal code constraints were sidelined until the final stage of the process. This enabled the design to be pushed a lot further but elongated the final extraction process, as elements such as accessways needed to be significantly altered to meet the New Zealand building code and regulations. Some alterations are still required to meet these standards although the final designs within this research process were deemed sufficient due to their hypothetical nature. To make this final stage flow more efficiently some of the regulations should be brought in earlier such as door and stair regulations being considered more closely in stage three of the framework, which focuses on thresholds between spaces.

It is hoped that the proposed framework emerging from this research is offered to be applied in many other design projects. It will aid in changing the way in which designers think about their designs, and ensure that the senses are involved throughout the entire process, creating a stronger and more emotive atmosphere.

Because the process in this specific design-led research was very long and very detailed it took an extended period of time to move through it. It could be a good first step to look into how the framework could be streamlined.

The level of detail within the framework ensures that the quality of the design would be at the same level each time regardless of the differing outcomes, however if a designer wanted to apply the framework but had a short period of time in which to do it a streamlined framework could be useful. During the testing process the first three stages seemed to be quite fluid. Refining the key elements to complete within these stages would reduce the time spent moving back and forth between stages which would also likely shorten the process. The time taken within each stage could be shortened by moving on to the next stage whilst still at a very vague and conceptual level. This does however extend the time spent in the fifth stage as the development of each element would need to be more in depth. As stages two and three were found to be quite fluid during the testing process, these could potentially be moved through simultaneously, however care would have to be taken to ensure no elements were missed.

Throughout the testing of the framework, some pieces seemed to have been left behind or forgotten. This was deemed to be due to a lack of clarity or specification in the framework itself. Without testing these issues may not have been picked up on. The framework was revised accordingly. The next step would be to test the framework a second time to ensure that the process flows smoothly.

# The Revised Framework

Each stage had issues that arose. The issues were addressed and the entire framework was refined to remedy these and make the process flow more fluently. Stage 1: Both individual and overall volumes are decided and physically modelled in this stage. Stage 2: Using both physical and digital modelling, the tactile features and interior elements of each space are conceived within this stage. Physical modelling remains as the primary method of conception. Stage 3: Thresholds and access routes between spaces are formulated using physical and digital modelling with consideration of national standards and regulations. Stage 4: Through addition of lighting and colour to enhance tactile qualities, and the selection of materials through tactile methods, the interior is pushed to oversaturation. Stage 5: The final stage edits down the oversaturated interior, and develops the design into a functional small home. This process is finished by creating another final physical model to ensure elements from all stages are included and developed and that all criteria are met.

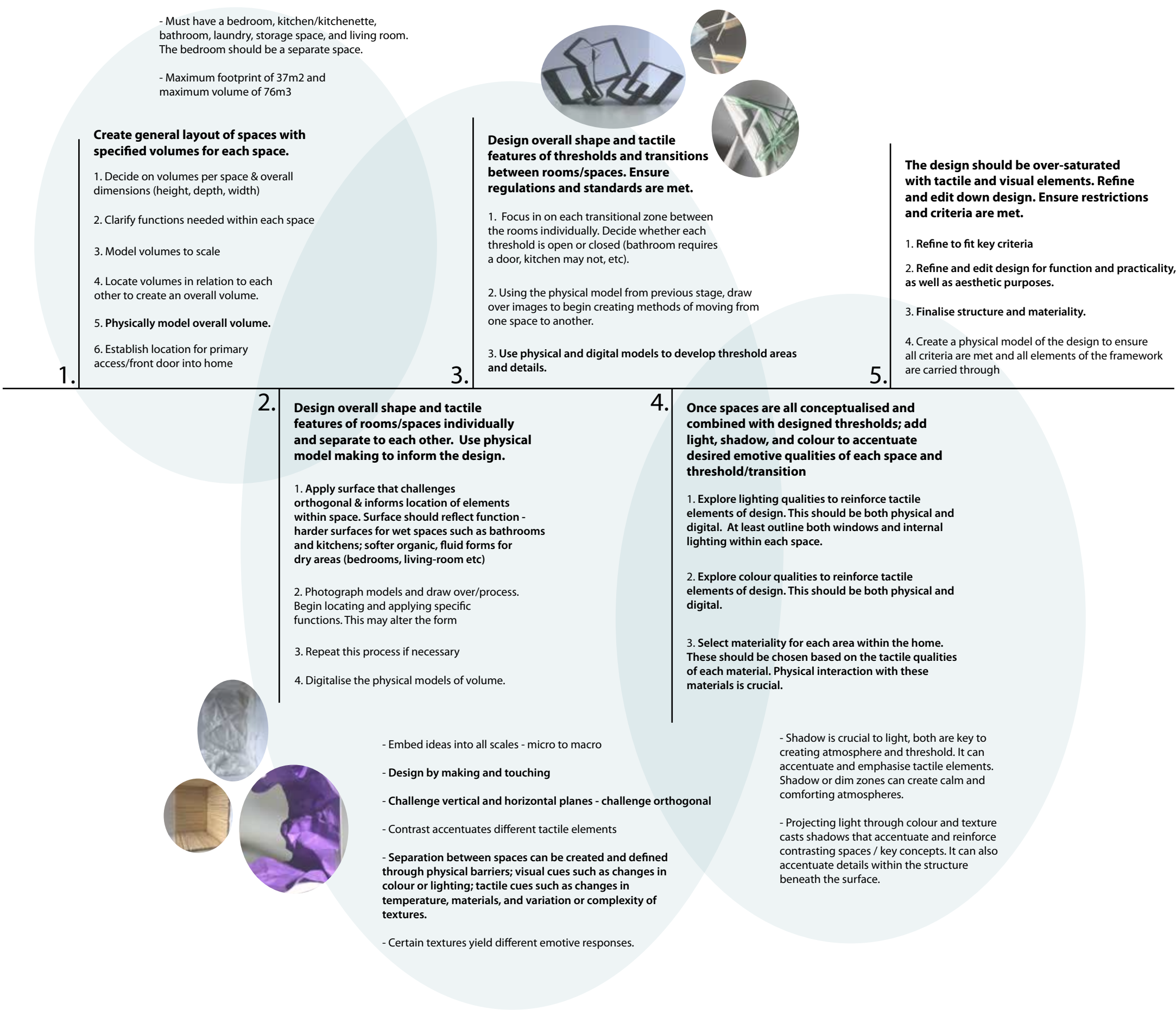


Figure.284



# Overall Reflections & Conclusions

The goal of this body of work was to create a method of designing an interior architecture centred around the body and senses, with touch as the primary sense considered. This method was then put into the context of the housing crisis and tested through the design of the interior of a small dwelling.

The process began as very theoretical and hypothetical and became gradually more tangible throughout the development of the work. By doing a reasonable amount of written research into the initial topics of small space living and the about body and senses, a solid knowledge base was formed. This knowledge was then tested and used to experiment with in order to build further understanding of the topics discussed, and to begin the design process. Through developing stages of physical models that were each informed by the set that came before, findings were developed and refined into a key set of criteria. These criteria were what formed the resulting framework of designing small space living through the sense of touch. To test this framework, the project of a small dwelling was created. Throughout the testing process, notes on how the framework worked and did not work were taken and reviewed to assess and refine the framework itself. Without this initial knowledge base and beginning with theoretical elements, the experimentation from chapter three onwards would not have been as strong, and therefore the process itself would not have flowed as steadily.

Certain elements from initial experimentations were not carried through as strongly as others within the framework. These elements instead went on to inform design decisions during the testing of the framework, or were lost along the way. Previous lighting experiments could have

been explored more in depth such as the lighting experiments done using the KODA model and perforated surfaces to create shadows could have strengthened the design. These experiments did, however, form the base of the chapter four experiments with shadows which carried through to the application of the framework.

There are many elements that other designers can take from this process. The first conclusion drawn through this research is that when designing for touch, tactile methods and analogue modelling are crucial. They allow the sense of touch to be integrated into all steps of the process, and therefore at every level of the resulting design.

The senses are very difficult to separate in the experience of space, so to design a space by considering only one sense is also difficult. Though the primary focus of this research was the sense of touch, tactile methods were enhanced significantly through light and colour. This would be further complimented through consideration of smell, hearing, and taste. Through actively factoring multiple senses in when designing, the atmosphere within an interior is strengthened immensely.

The framework itself can also be applied in many situations and briefs. Although the framework works best as a whole, each of the stages can be taken and applied individually or with only one or two of the other stages. As tactile methods are used throughout, with surface and texture as a key consideration within each step, the outcome would still have a strong focus on the sense of touch. The framework can also be used to design within an orthogonal site or interior of an existing building with ease. Stage one of the framework is where any

overall dimensions and volumes can be set, so this step is streamlined and certain decisions made for the designer when there is already an established volume to begin with. By physically modelling the existing volume in which the designer would be working, stage one is effectively completed, and the subsequent stages can be followed to completion.

There are multiple ways in which this research could be continued on. One would be to test the revised framework through application into a design. This would ensure that it flows effectively, and that the refining of it was successful in fixing the issues that were picked up during the first test. Another option would be to do research into high density housing situations, taking the framework and developing it further within the context of high density housing to utilise as a tool in creating an effective solution to the housing crisis. The third way in which this research could be further developed would be to repeat the research process for each sense and establish a framework that is driven by all of the senses equally.

The author wishes for the framework of interior design based on the sense of touch to be further challenged and enriched; that the process of shifting between analogue and digital explorations be further explored; and that the balance between intuitive work and analytical process be tested.

More importantly, it is hoped that this design-led research will stimulate other designers to consider the senses as the central focus of future design processes.





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