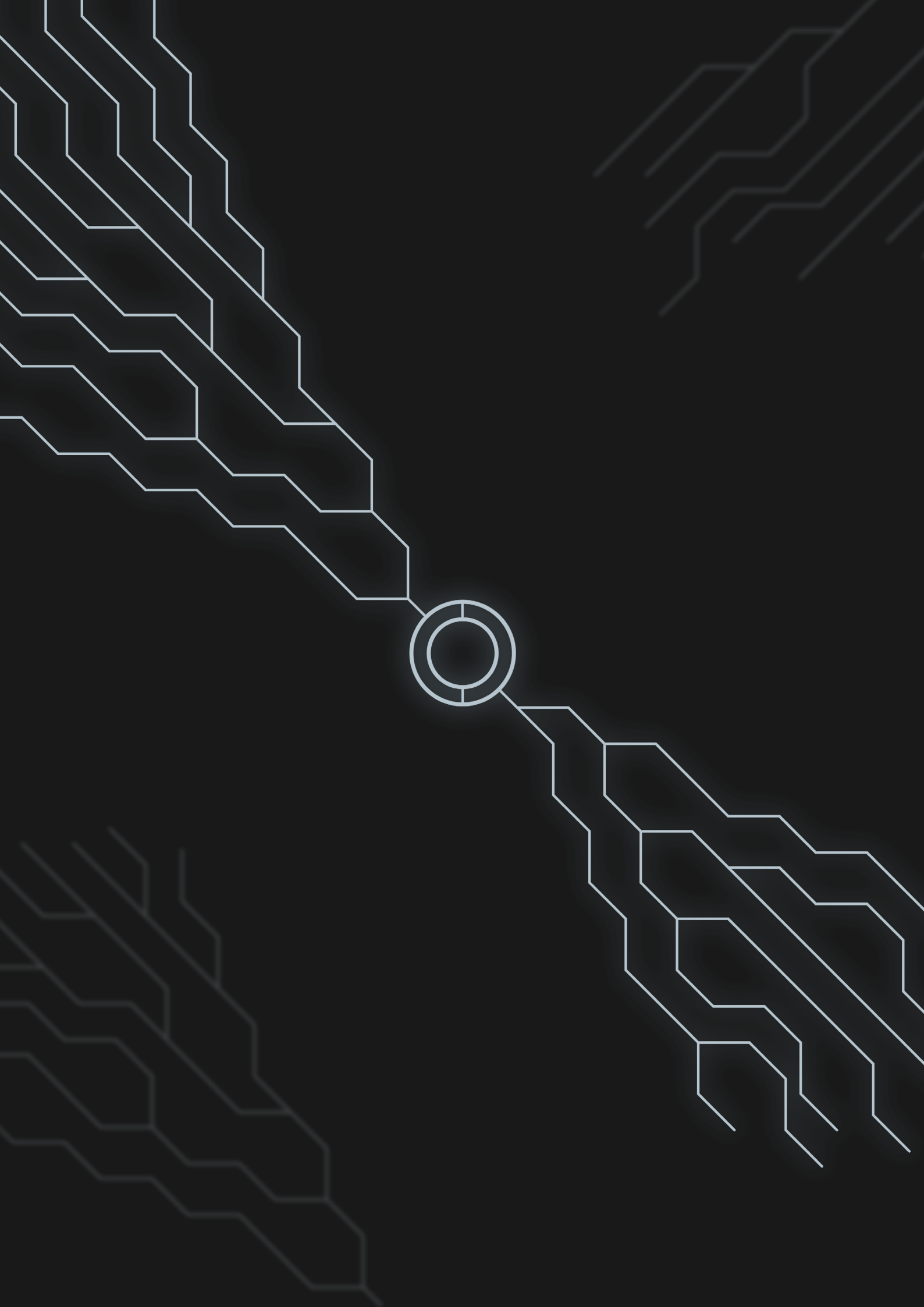


# Tech-n iR

AN EXPLORATION OF INTERIOR SPACES  
IN AN URBAN CONTEXT GENERATED BY  
EMERGENT TECHNOLOGIES

DANIEL SEBASTIAN JACOB





# Tech-noiR

## AN EXPLORATION OF INTERIOR SPACES IN AN URBAN CONTEXT GENERATED BY EMERGENT TECHNOLOGY

A 120-point thesis submitted to the School of Architecture and Design,  
Victoria University of Wellington, in partial fulfilment of the requirements for the degree,  
Master of Interior Architecture

Victoria University of Wellington  
School of Architecture

2019

DANIEL SEBASTIAN JACOB



NOW LOADING...





## **ABSTRACT**

Poor pedestrian and transportation circulation, overpopulation, expensive cost of living—these are some of the issues inherent to any urban metropolis around the world. As cities develop and grow, more job opportunities open up for people, which leads to the increase in city population. This growth affects the city's lifestyle, leading to overpopulation, poor circulation and expensive cost of living within the urban centre. Influenced by the concept 'time is of the essence', urban living has become synonymous to an autonomous service stuck within a loophole. This lifestyle, now further propelled by the presence of technology, can prove to be detrimental to the inhabitants' comfort and well-being. In order to adapt to an impending future of the urban areas, an alternative to future urban living using technology with a minimal yet comfortable dwelling must be provided.

The thesis proposes that emergent technology as a design-generating tool along with ergonomic design and depictions of visionary architecture are capable of producing an alternative to urban minimal dwellings in the future. It contends that these future urban minimal dwellings can be developed by: mapping and understanding emergent technologies potentially usable in interior architecture that can be developed into tools; collecting and analysing ergonomic principles and techniques appropriate to interior architecture; collecting and analysing literature about minimal dwelling in modern history; and analysing components and technologies used in depicted living spaces within selected filmography.



## **ACKNOWLEDGEMENTS**

To my supervisor, Daniele Abreu e Lima, thank you very much for the support you have given me throughout the past years—From our group meetings, to our segwayed discussions that, more or less, broadened my perspective of the world. Without you, my experience of doing my final year in Interior Architecture would have been dull and unfulfilled.

To my family, thank you very much for supporting me for the past six years of my architectural studies; achieving all these accomplishment in all these years would have remained a dream.

To my friends and cohorts, thank you very much for the support you have given me every day. As fellow comrades who have surpassed this gruelling milestone, I wish you all the best of luck in the future.

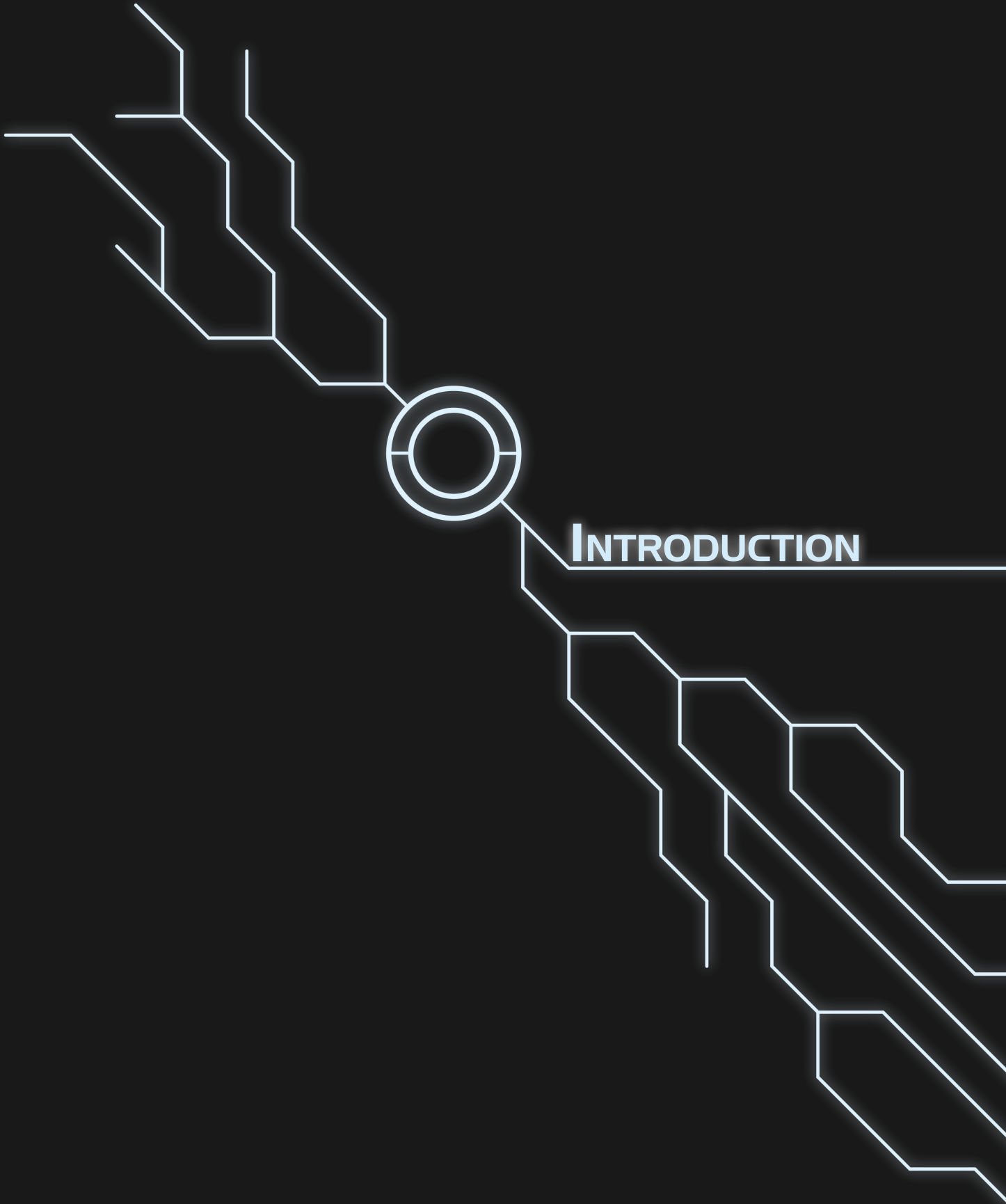




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**INTRODUCTION**



As most millennials, my visual interests were massively influenced by visionary futures depicted in films and video games. The universes created in these media, though completely fictitious, were and still are part of my subconscious reality. Evidently, I am able to distinguish the difference between the conscious and the subconscious, but as the work of an entire part of medicine and psychology would argue, all that is in the subconscious influences the perception of reality.

When it was time for me to decide what I would choose as my thesis project, I was certain that I would elect a theme that involves futuristic and visionary design. As an Interior Architecture student, I was also extremely interested in minimal dwellings that are becoming significantly smaller as the urban centres became enlarged.

New Zealand still does not suffer from overpopulation nor from the spatial struggles experienced by other capitals around the world. I originally came from Manila, Philippines, which according to the country's 2015 Census, has over 12.8 million inhabitants living within the city. However, in comparison to other major cities I had the pleasure of experiencing, Manila's urban living cannot be seen as a dire case. Sometimes, issues with land availability or even cultural traditions have a more decisive influence in the way urban dwellers inhabit their cities. New York, Hong Kong, Delhi, and Tokyo are examples of extremely dense city areas that end up creating a minimal way of living considered unthinkable for those who live in New Zealand cities.

Nevertheless, what if Wellington became overpopulated and, as in most cases of today's urban metropolises, there would be a part of society that, for preference or lack thereof, live in the CBD area?

My proposal merges my personal interest in visionary and futuristic architecture with the problem of minimal dwelling that appears to be integral to all metropolises. To help with research, I selected Simon Sadler and Ernest E. Burden as my key authors in the areas of visionary architecture. I also researched Metabolism and modern minimal dwellings, with Kisho Kurokawa, Le Corbusier, and Ernst Neufert as my key authors for the area, respectively. The thesis is divided into seven chapters.





The first chapter establishes the issues pertaining to the thesis. It enumerates in detail the issues inherent to all urban metropolises around the world as well as other concerns such as the influence of emergent technology and that will affect the urban areas and urban living in the future. This chapter also establishes the aims and objectives of this thesis, as well as the research scope undertaken by this thesis.

The second chapter is a review of literature. It uses and builds upon literature about visionary architecture, Metabolism, emergent technology and minimal dwelling—its intentions and how these intentions influence the foundations of an alternate to urban minimal dwelling in the future. This chapter also uses literature to establish the key principles that will manipulate the design approach of alternative urban minimal dwellings in the future.

The third chapter introduces the site in which the thesis is situated, the proposed alternative for urban minimal dwelling in the future. It includes circulation analyses of the site at its current state and in the future, based on the issues of urban areas and the findings from the previous chapter.

The fourth chapter is a review of three case studies: the cage and/or coffin homes in Hong Kong, Kisho Kurokawa's *Nakagin Capsule Hotel*, and James Law Cybertecture's *OPod Tube House*. These three case studies represent different approaches to the same issues regarding urban living and minimal dwellings that future urban minimal dwellings will need to address. They include: importance of a salubrious and comfortable dwelling, maxi-minimal limit of minimal interior spaces, overpopulation, and the influence of technology as tools to generate the interior space and exterior form.

The fifth chapter is a series of experimental studies guided by the case studies and literature from the second and fourth chapters. It offers an understanding of potential design studies that may be optimal for an alternate urban minimal dwelling in the future. This chapter is a pre-requisite to the sixth chapter.

The sixth chapter is a design study that assesses the findings of the previous chapters in a detailed design solution. This chapter examines what an alternative to urban minimal dwelling in the future might be like—using ergonomics, technologies, mobility and interaction as the primary means to characterise this.

The final chapter extracts on the previous to discuss the results of this thesis and what was accomplished during the process. It also discusses any potential alternative that may have improved the findings of the thesis and addresses the potential opportunities this thesis may implicate in the future.





# CHAPTER ONE

FUTURE METROPOLIS,  
FUTURE LIVING





## I.I THE FUTURE OF URBAN LIVING

After 100 years of architectural studies, considering the inauguration of the BAUHAUS as the starting point, modern architecture still faces similar problems. Among them, the minimal dwelling is still a paradox in contemporary architecture even after thousands of alternatives being created following the legendary second CIAM (Congrès Internationaux d'Architecture Moderne) in 1929. Urban minimal dwelling is still a challenge for architects around the world. In any metropolitan area there is always the demand for better, more comfortable, and yet affordable and minimal dwellings that not always have an appropriate response by architects and developers.

Though suburban life in larger homes continues to sprawl in the world's metropolises, some issues will always make inner city living an attractive alternative.

### I. Circulation

The issue of urban accessibility – there is no metropolis in the world that does not suffer from the problem of urban circulation. Traffic jams are common everyday life occurrences, and commuting is usually extremely time consuming and expensive. Some metropolises are trying to tackle that by subsidising public transportation and establishing ways to reduce the price as most metropolitan commuters have to use more than one mode of transport, ranging from bus, trains or subways; to and from their workplaces and homes (Rosenberg, 2018). Still, time is a major issue for those who live in any major urban city.

The urban circulation is not only regarding access to work and back home, but access to the city itself—from the services to the amenities offered by a metropolis. For instance, on a weekend day in a metropolis going to the park, then cinema then to a restaurant the journey will usually include some hours in traffic jams. If the dwellers live in the suburbia, the trip to the city would be even longer, leading to the isolation of suburban areas from the heart of the cities.

Figure 1. Bus stop by the MRT Boni Station in Metro Manila, Philippines (top).

Figure 2. Freeway traffic in Los Angeles (middle).

Figure 3. Daily traffic congestion in Metro Manila, Philippines (bottom).







## 2. Overpopulation

Most metropolises have developed urban planning projects throughout their history to organise the city centres. Cities as Paris, London, Hong Kong had numerous urban interventions that build, destroyed and reconstructed areas of their city centre (Benevolo, 1980). Some of these interventions were very successful; some created unexpected problems (Vox, 2018). With all planning and infrastructure, most inner-city centres of major metropolises became overpopulated since the beginning of the 20th century (Rosenberg, 2018). And though there were projects to de-centralise the centres and migrate population to newer and better developed districts, there are still huge percentages of the population living in the centres.

As a matter of fact, the urban projects developed to de-centralise centres and/or migrate business and commerce centres to districts better planned after generated abandoned areas within the cities that were easily occupied by the lower economic class (Hoyt, 1941). Some of the abandoned areas became squatter settlements and slums, and though each metropolis has specific problems and circumstances, these urban slums became a reoccurring issue (Idem). Kowloon, Hong Kong can be seen as the ultimate example of this problem. The walled city's area was developed on land belonging to the Chinese government, but it was surrounded by the British territory. So, the Chinese government had no direct access to the area and the British could not interfere, leading the population to make use of the existing infrastructure by themselves. With no building rules, Kowloon became one of the densest and most unsafe urban neighbourhoods due to its codeless constructions, lawlessness and lack of emergency services until the British government returned Hong Kong to the Chinese government.

Figure 4. Landscape of a favela, an urban Brazilian slum, in Rio de Janeiro. 2009 (top).

Figure 5. Night-time at Times Square, New York (middle).

Figure 6. Store owner inside Kowloon Walled City preparing some ingredients along with children (bottom).





### 3. Cost of Urban Living

With the high demand for urban dwellings in metropolises, the cost of urban living proportionally increases as well. The cost of urban living not only involves basic expenses such as housing, food, taxes and health care, but also includes expenses procured during city circulation such as public transportation, extra food, parking, hobbies and leisure activities. These expenses may seem trivial; however, they promote the financial and economic growth for the city, in turn increasing the city's value and cost of living – the cycle begins anew. Even with constant increases in the cost of urban living, why do people still choose to live in, or near, city centres?

Using Kowloon's Walled City once more as an example, why do people remain living there despite such appalling living conditions provided by the place? The reason can be summarised in one phrase – *time is of the essence*. There are two perspectives reinforcing this concept:

- Minimal urban dwelling, more commonly known as micro-apartments, is an existing viable accommodation that offers low-prices compared to traditional accommodations (Hargreaves, 2016). Although they are marketed as low priced, they are in fact expensive and only affordable to the affluent and high-income earners. Popularised in 2013 and recently rising in trend as of 2018, these ideal urban dwellings offer the benefit of a living location within the city centre thus cutting costs from city circulation expenditures. Although more expensive than living in a conventional urban apartment, this alternative is preferable to the other.
- In developing countries, most people working in metropolises often live outside the city centre and commute from suburbs and even towns outside the metropolitan area. To be able to live somewhere within the city centre is a luxury these wage earners would want, and the high cost of urban living makes this a pricey challenge. As a result, most wage earners would end up living in subsidised housing or the slums at worst.

Figure 7. Shoe Box apartment by Lebanese studio Eliemetni (top).

Figure 8. Inside a train heading to downtown Seattle, USA (middle).

Figure 9. A miniature 90 square foot apartment in New York City, USA (bottom).

The disparity between the high-income and low-income inhabitants is clear, yet for each individual, the concept of 'time is of the essence' resonates within like an alarm clock – it cannot be ignored; no matter how many times it is snoozed, it will keep ringing.







Modern society has become a consumerist society. It is embedded within the human psyche to want more; and more people consume products not only to show their financial status but to also alleviate boredom and provide a sense of happiness and fulfilment. Consumerism in New Zealand is on a slow rise due to the efforts of New Zealanders trying to mitigate excess spending by promoting consciousness of wastefulness and dispersing high quality products as the result of the 2008 Global Financial Crisis (Watkins et al., 2015). These changes do, however, bring concerns and are arguable for several reasons – trading off higher product quality for a cheaper price increases the risk of shorter product lifespan due to its low quality, and an increase in demand for social welfare support from the government results from the more vulnerable sectors of society losing more of their already miniscule spending power (Idem). With all the spending city inhabitants are making, the real issue remains: where will all of these material possessions be stored in an urban dwelling? Modern urban dwellings are becoming smaller and more minimal with the trend of micro-apartments and tiny homes that comfortable living spaces, yet they are expensive and also only provide limited functionality and services that seem unsuitable for inhabitants. Storage space is another concern these types of dwellings encounter – the lack of storage space in a consumeristic society will only result into more unnecessary and avoidable expenses for the inhabitants. The minimal dwelling became smaller than initially envisioned and will continue to become smaller in the future; therefore, a comfortable, functional, space-saving and storage-friendly alternative urban dwelling needs to be developed.

Figure 10. Visual interpretation of a consumer's mind (top).

Figure 11. In-store bargain sale in Singapore (bottom).



Humanity's increasing technological advancements every year are another growing concern that coincides with future issues metropolises face. Urban inhabitants are becoming more dependent on technology in more ways than one – mobile phones having the capability to access nearly all types of devices, 5G Internet and Wi-Fi hotspots encompassing an entire city, self-driving driverless vehicles, smart homes that control and monitor households, and other technologies designed to improve and assist daily human lives. Aside from technologies transforming dwellings into smart homes, metropolises are also beginning to undergo technological conversions into smart cities in order to provide the inhabitants with a more productive, resilient and better urban life. Cities would be littered with forests of fully-automated buildings and sensors on every street to detect automobile and pedestrian traffic, public disturbances or criminal activities, and more. Living in a hi-tech metropolis within the next century would not be science fiction anymore – living within virtual reality or VR could be equivalent to living in the physical world much like how it can be implemented into all households as the new television and monitors, or how augmented reality or AR will be used as another display accessory for people and transforming how the building façades, billboards and signage only need to be displayed through AR peripherals overlapping these elements. The Internet would be overlaying the physical world through mixed reality, exposing humans and leaving them susceptible to harmful circumstances involving technology.

- Cyberdelic addiction is the tendency to over abuse technology use to provide an addictive stimulation similar to psychedelic drugs. Someone suffering from this addiction tends to surf the Internet for too long, thus potentially transforming them into NEETS and/or shut-ins that browse the Internet all day without doing anything productive.
- Technology addiction refers to an impulse control disorder involving the obsessive use and procurement of mobile phones, video games, and/or the Internet, despite the negative effects on the user's psychological and physical wellbeing. Like cyberdelic addiction, this has the tendency to convert the individual into shut-ins and/or NEETs. Children are more susceptible to technology addiction, and with how technology is now heavily embedded into society, almost everyone in the world is addicted to technology to some degree.
- Cybercrimes have been rampant since the advent of the Internet. From simple viruses to full-blown hacking, these crimes can and will affect anyone with access to any electronic device. The threats of cybercrimes are even more alarming since technology and the Internet are now part of the everyday lives of people, and in a hi-tech future, no one is safe.

Figure 12. A dramatisation of using a VR headset (top).

Figure 13. Touch display information panel on streets (bottom).





## **I.2 RESEARCH QUESTION**

*How can interior architecture offer an alternative to future urban living utilising emergent technology and also provide a minimal yet comfortable dwelling?*

## **I.3 AIMS AND OBJECTIVES**

This thesis intends to accomplish the following aims and objectives:

1. To understand the capabilities of emergent technology as a design generating tool. This is achievable through mapping emergent technologies maybe usable in interior architecture, and by understanding basically how each one of these emergent technologies works.
2. To understand minimal dwelling design throughout modern history. This is attainable via collecting and analysing literature about minimal dwelling in the 20th and 21st centuries.
3. To understand ergonomic design applied to interior house design. This is achievable via collecting and analysing ergonomic principles and techniques that can be applicable to interior architecture.
4. To overview visionary architecture depicted in films and/or literary work that can have a real use in future living. This is attainable through analysing, within the selected filmography, the components and technologies used in the depicted living spaces.



## I.4 SCOPE OF RESEARCH

Designing for future urban living issues involves numerous factors that will affect the design's outcome. Undertaking all these factors within this research is improbable due to the sheer magnitude of the factors, let alone the time required to understand and analyse at least one of these factors would affect the research's timeframe. Although it would be highly beneficial to the research's efficacy to include them, there is simply not enough time. To ensure effectiveness and quality, the scope of the research only encompasses factors with utmost relevance to the research's aims and objectives. An organogram of the research's aims, entailing the relevant factors involved to both the research focus and designing for future urban living issues is first constructed, which is then specified into the key themes that ground the entire research.

Firstly, this thesis explores the concept of a future metropolis based on current urban living issues, trends in society, and drastic changes brought by natural disasters. All metropolises, current and future, are bound to encounter these factors, which in turn form and highlight the different culture of each metropolitan dwellers. Only present-day urban living issues, social trends, and forecasted natural disasters are considered for the research to maintain realism and probability of these factors persisting in the future.

- Lack of urban dwellings within the city centre due to overpopulation.
- Terrible urban circulation for pedestrians and vehicles within the city centre.
- A consumeristic, yet conservative attitude towards the economy and finance.
- A techno-savvy society, reliant and addicted to modern technology for almost all daily needs.

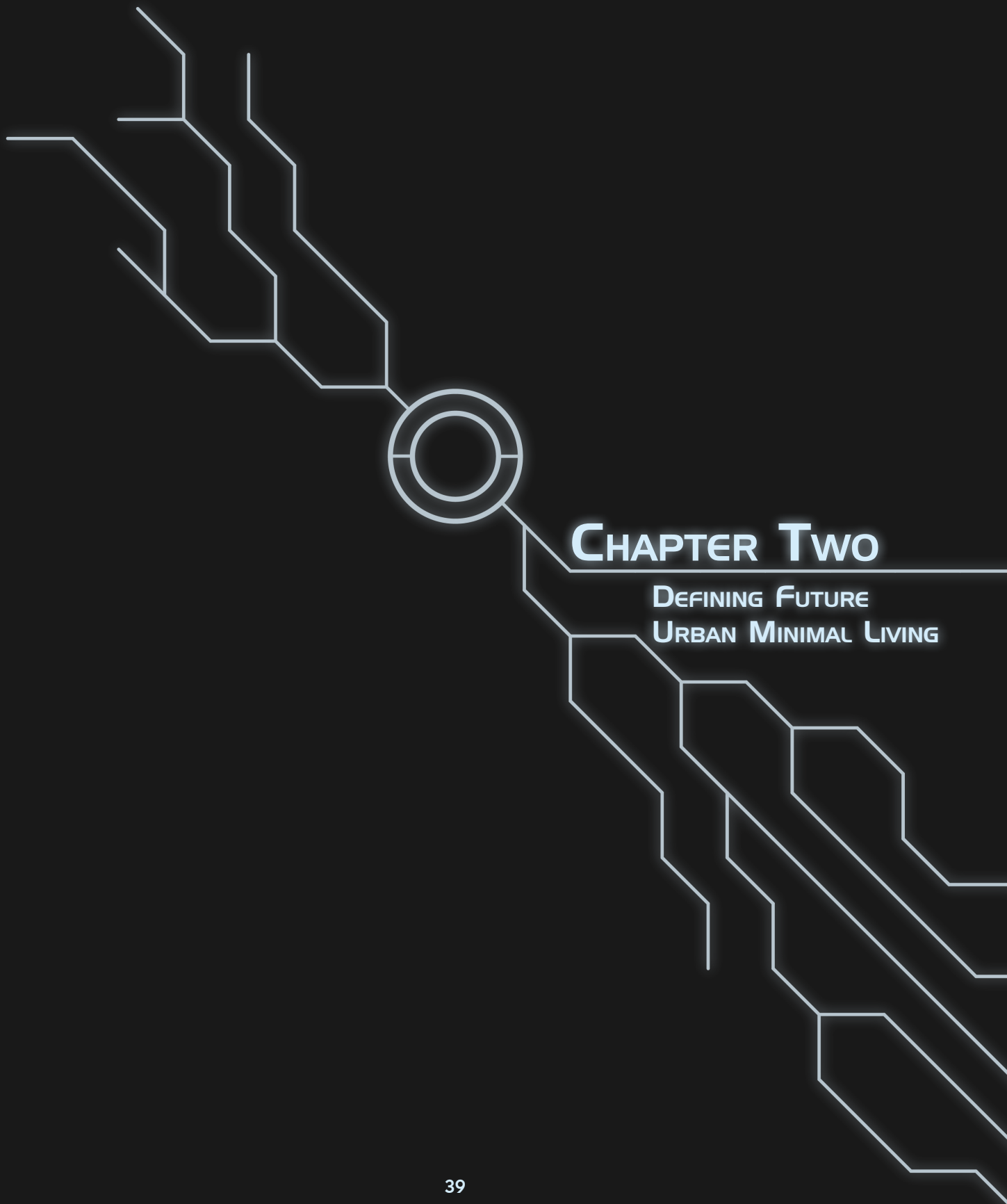


Secondly, this research explores the concept of the necessities of human needs versus the luxuries of human wants – the maximum/minimum conditions to support urban living. The contrast between these two assesses what target clients value of importance, their personal beliefs and preferences, and these in turn dictate the minima and maxima of human living conditions in the future.

Lastly, the research explores humanity's technological strides, and consequently, the potential effects of these technologies on humanity's urban lifestyle. Technology plays an important role in the research since technological progress correlates to human progress, and human productivity derives from an individual's skills and their tool utilisation capabilities. Understanding emergent technologies and their effects, both positive and negative, on human lifestyles determines the urban lifestyle the target clients will be exposed to in the future.

Establishing the research-relevant factors forms the foundation of the entire research. By applying the knowledge gathered from each of these relevant factors, a universe for this research is created, one that dictates a potential future of urban living based on real and current information.





## CHAPTER TWO

DEFINING FUTURE  
URBAN MINIMAL LIVING

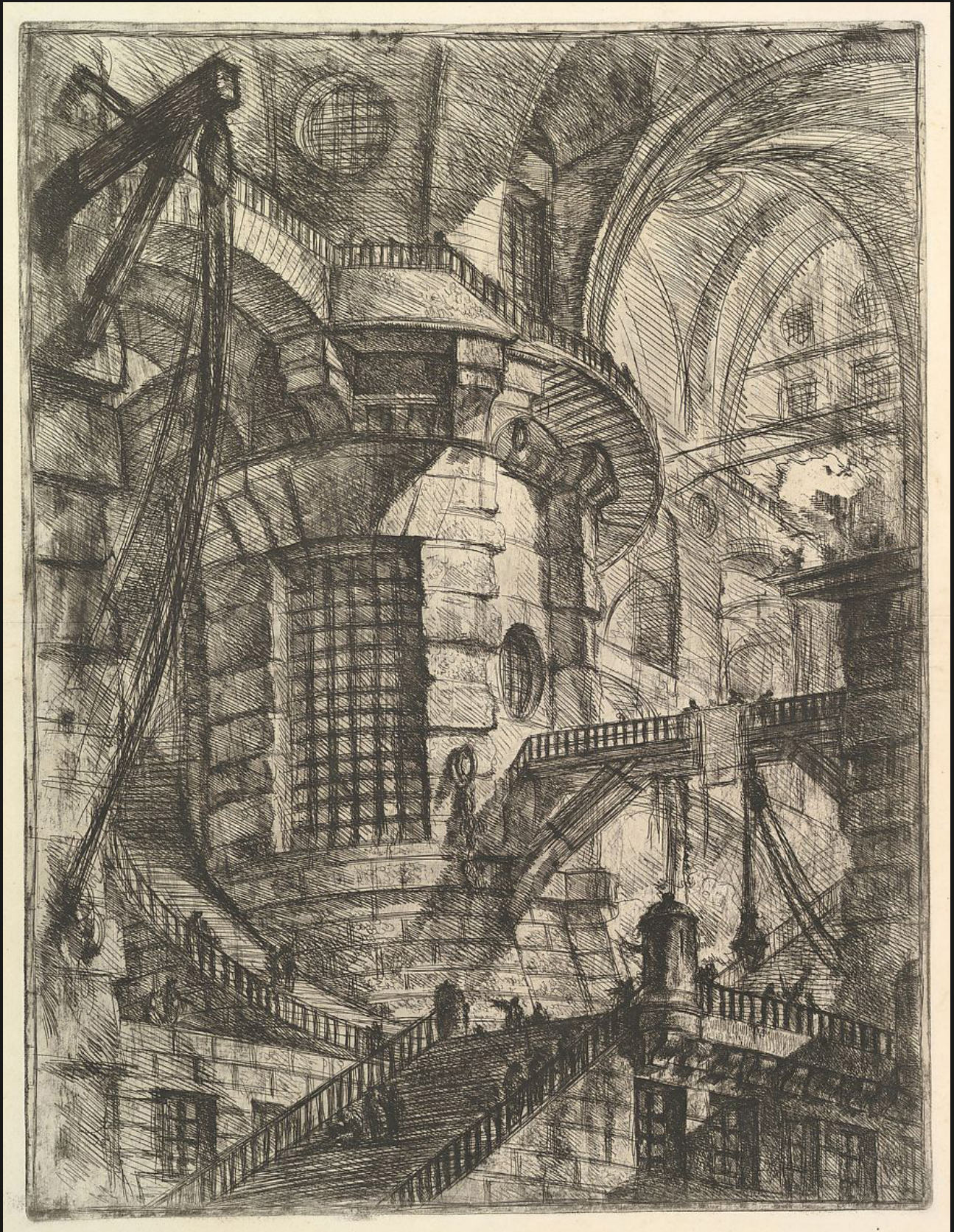




This chapter is the accumulation of literature reviews regarding the research's key themes – visionary architecture, Metabolism, emergent technology and *existenzminimum*, and their crucial task of establishing the foundations of an alternate future urban minimal dwelling. It aims to construct and build upon the existing knowledge with regard to the conventional perception of future urban living, the practical and ideal approach to minimal living, and the potential application of emergent technology as tools for generating urban minimal dwelling designs.

This chapter is organised to provide an in-depth understanding of each of the key themes. It details succinct information regarding each theme and establishes their relation to the research. Included are each of their histories, influences, and inspirations they instigated to the progression of the modern world. A priority is how an alternate future urban dwelling is conceived through the inspiration of the key themes. This involves establishing how each key theme manipulates certain aspects of the future urban living and redefines the conventional approach of design for future minimal urban dwellings.







## 2.1 VISIONARY ARCHITECTURE

Aptly named for its concept, visionary architecture based on the act of imagination and vision dissociates the physical nature of architectural design (Burden, 1999). Though practically impossible, the idea of visionary architecture implies the creation of architectural design through sheer inspiration and without the limitations imposed by the world's conventions. Although there are many connotations for the concept, basic understanding can be offered by John Walker's *Glossary of Art, Architecture and Design* (Walker, 1992) where he named two different perceptions by E.E. Burden that define the nature of visionary architecture:

- There are no unbuildable buildings – only unbuilt ones;
- Some drawings are impossible to be inhabited by humans (Burden, 1999)

While there is no direct qualification associated with the term *visionary*, it is commonly accepted as idealist, ground-breaking, avant-garde and positive types of architecture such as the works of Renaissance architect Giovanni Piranesi and Joseph Michael Gandy (Burden, 1999). The depiction of imaginary designs, as the terminology obviously associates, differs since they all originate from individual imaginations. The unique imaginary designs not only allow for the deviation brought by an individual's uniqueness, but also "the depth and breadth of references which a creative imagination can draw upon as it works on the referential content it manipulates" (Coleman, 2005). If one follows a visionary approach, one must cast aside common preconceptions and embrace their raw, unfiltered imagination, and one will achieve designs that exude their respective individuality within.

Figure 14. The Round Tower, from 'Carceri d'Invenzione' (Imaginary Prisons) by Giovanni Battista Piranesi, ca. 1749–50.



Another interpretation of visionary architecture would be the idea and belief that these drawings and images are able to portray the true meaning of architecture and design that connotes the significance of the works (Burden, 1999). An idea originates from some form of influence, whether direct or indirect to the formed idea itself (Idem). In architecture, history is a constant influence that cannot be dismissed as easily; as it plays the integral role of providing the necessary wisdom and principles that guide every architect to their desired design. To be fully inclusive for instance, the history of architecture should incorporate not only the architectural projects built but also those that were conceived but deemed impossible to build (Rossi, 1982). I believe it is part of the education of an architect to understand its history in order to grasp their intended design, disregarding whether or not the design itself is pragmatic or idealistic, though the practice of architecture is usually detached from such theoretical approaches. Visionary architecture has the potential to inform the design and speculate about different alternatives to common problems.

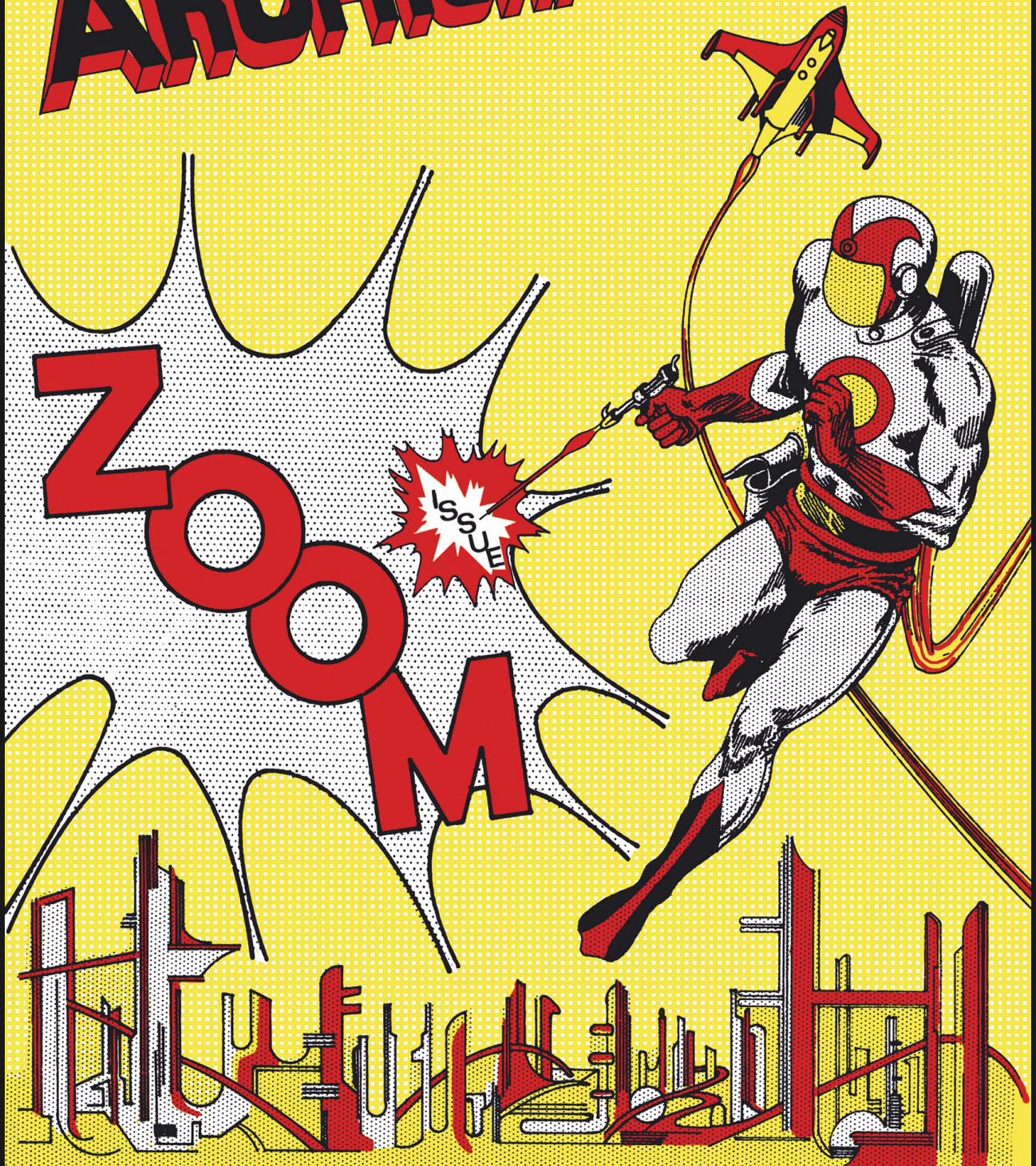
Figure 15. Joseph Michael Gandy (1771-1843), Public and Private Buildings executed by Sir John Soane between 1780 and 1815, 1818.

Among the many visionary schools and movements in architecture, *Archigram* became the main source of reference from the beginning of the thesis and ended up definitely informing the thesis's design methodology and experiments.



# AMAZING ARCHIGRAM 4

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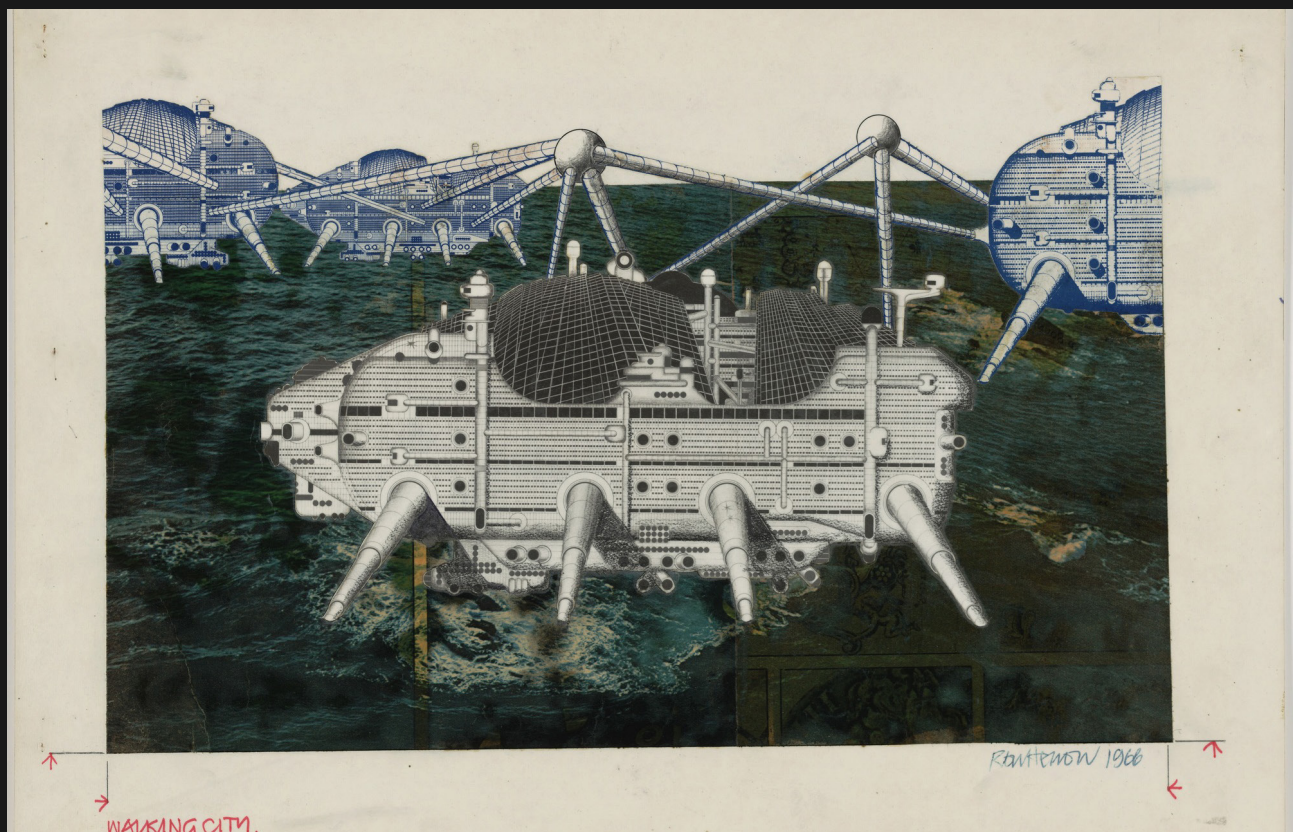
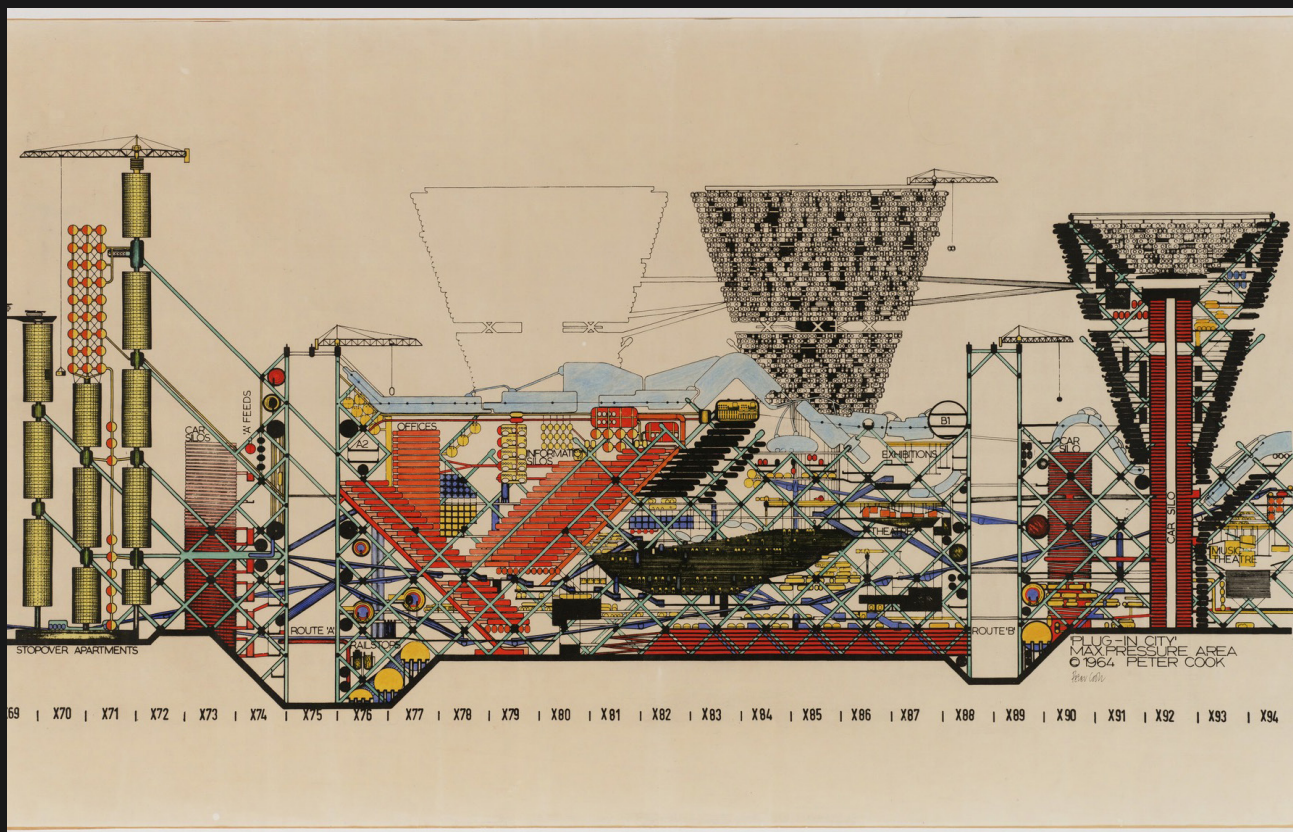


## Archigram

Among the well-known advocates of visionary architecture is the neo-avant-garde group *Archigram*. Founded during the 1960s, the group was “a reaction against the generic, glass-and-concrete grids of the early sixties *modern architecture*” (Sadler, 2005). Their manifesto is to draw inspiration from technology in order to create a new reality that is solely expressed through hypothetical works. Their works, published in nine main issues from London between 1961 and 1970, are considered anti-heroic, pro-consumerist and neo-futuristic during that period.

*Archigram*’s vision for an alternative to London’s Modernist urban grid coincides with the thesis’s aims and objectives. Their experimental works provide a great insight on potential approaches to designing for future urban living. *Archigram* member Peter Cook’s iconic *Plug-In City* is considered the experimental work that “most thoroughly encapsulates the preoccupations of *Archigram* in its early years” (Sadler, 2005). Emphasising the repressed motifs of megastructures and building-in-becoming found in Modernism, Cook translated his vision of future urbanism based on the combined elements of “the principle of collectivity, of interchangeable apartment units, and the incorporation of rapid transportation links” (Idem). The mentality of treating “housing as a consumer product” (Idem) would lead to the re-propagation of prefabricated building systems and cutting-edge architectural engineering developed by people such as Frei Otto and Jean Prouvé, who established an innovative method for prefabrication (Copans & Neumann, 2001).

Figure 16. An Archigram magazine cover page.





Unlike the systematic, whimsical yet graspable approach to urbanism of Cook's *Plug-In City*, fellow *Archigram* member Ron Herron's *Walking City* leaned more towards the fictional part of science fiction when I came to its scheme. Although it was considered implausible during the time, *Walking City* became one of *Archigram*'s well known images since it was "a bold memorandum of forgotten modernist ambitions: to make collective dwellings, transcend national boundaries, build machines for living, extend human dominion, alter everyday perception, bring people into contact with the elements, and simply excite the public about the future" (Sadler, 2005). It most definitely feels wittier than *Plug-In City* as it appears more playful and has the 'child-like' innocence to its design; and despite it being improbable, the design adheres to the same *Archigram* principles yet it yielded a completely outlandish version of future urbanism. This illustrates the important habitual relationship between creativity, technology, history, and how individuality influences the manipulation of this close-knit relationship in forming imaginary future urbanism.

Both Cook's *Plug-In City* and Herron's *Walking City* provide necessary insight for conceptualising future urban dwellings through manipulating existing technologies weaving them into creative scenarios that utilise the technologies, and assimilate their design with them. By applying these principles to the thesis, it would be ideal to create a set of conditions dictate the extents and limitations of the whole thesis – a universe in which the thesis's conditions exist.

*Archigram*'s avant-garde interpretation of modern architecture appears out-of-the-world, high-tech and almost fictitious. Aside from the architecture movements advocating the architectural form, visionary architecture has also found a platform capable of expressing its principles through architectural designs depicted in films. Visionary architecture in film became another source of reference for this thesis since its beginning, and most definitely apprised the thesis's design methodology and experiments.

Figure 17. Plug-in City by Peter Cook, 1964 (top).

Figure 18. Walking City by Ron Herron, 1966 (bottom).



## Visionary Architecture in Film

Visualisation is a necessary tool to express a person's concept/s and provide any important information inexpressible through speech, either fully or partially, to other people. Film has always been a proven method of visualisation. Not only does it allow the visual portrayal of a narrative using spatial language, but it also details the subtle concepts within the narrative through the manipulation of atmosphere and camera techniques. It is unsurprising that the medium became one of the most efficient demonstration methods for visionary architecture. Examples of this visionary architecture are often found in genres such as science-fiction and fantasy, which mostly contain highly imaginative and unworldly world settings. Fantasy films emphasise illusory, whimsical and mystic concepts and depictions; thus, the defined architectural designs of the genre tend to be grandiose, rustic, and feudal in aesthetics, structure and atmosphere to encapsulate an enchanting reality ("Fantasy Films," 2010). Science-fiction, or sci-fi for short, films emphasise technology, scientific, and idealistic perceptions and representation, leading to more cognitive, hypothetical and lucid architectural designs that emit an innovative reality (Gandhy, 1985).

Out of the two genres of speculative fiction, sci-fi offers more insight regarding future urban dwellings. Sci-fi has several subgenres relevant to future urban living, such as cyberpunk, biopunk, and dystopian fiction (Booker, 2009). Selected for analyses in correlation with the thesis's research are seven different sci-fi films, all involving issues existing within the thesis's universe, and they portray unique approaches to future urban living. Although the timelines in each film span differently, all of them exist within a not so distant future and manage issues that may remain relevant. In each of the films, only interior living spaces are analysed since only this type of space is relevant to the thesis research. Part of the analyses of the films is an experimentation involving the recreation of the interior living spaces solely through the shots offered by the film and defining their framework based on the elements contained within each shot, all performed during one viewing. The films were viewed once more, however, this time comparing the findings from the first viewing and resolving any discrepancies.

Figure 19. A scene from Metropolis by Fritz Lang. 1927.

Overall, visionary architecture potentially formulated an approach to designing for future urban architecture, and in turn, potentially influencing how architects design future urban environments. The influence of visionary architecture not only persists in the manifestation of fantastical and futuristic architectural designs, but also invokes striving to pursue a future architectural design beneficial to the improvement of urban living. The thesis's outcome will be based on how well it implies the principles of visionary architecture into its design methodology, experimentation and design development, an outcome *Archigram* along with the Metabolist movement may have hoped to achieve during their time.



## 2.2 METABOLIC ARCHITECTURE

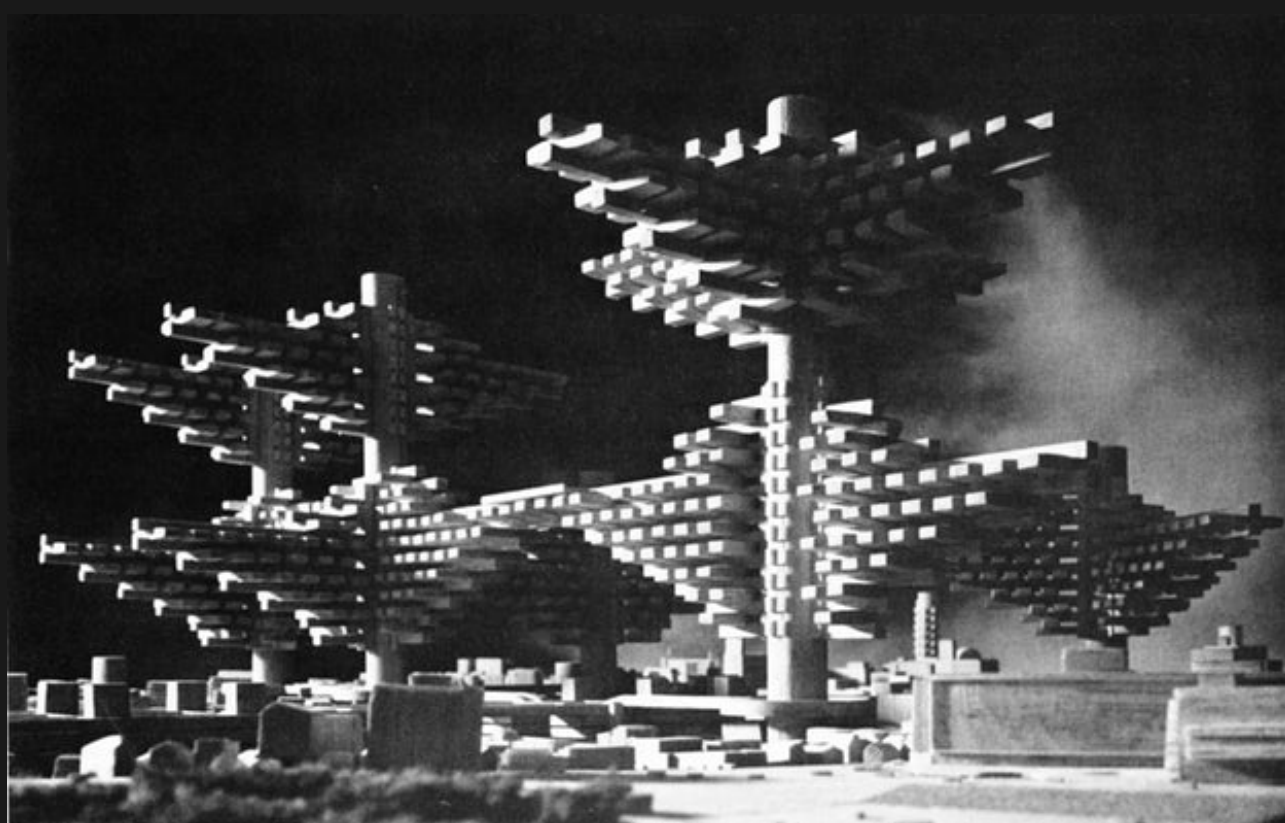
Based on the process of chemical reactions required to sustain a living organism's life, Metabolism is an architecture movement emerging from the post-modernisation period of Japan. The movement commenced in response to the changes brought upon by a period of astounding economic progress lasting more than a decade, and these responses were compiled as a proposal for the 1960 World Design Conference in Tokyo. The Metabolist movement's manifesto states that "their ideal is to design a city so flexible in its connections that its parts could grow, transform themselves, and die while the whole entity went on living" (Kurokawa, 1977).

The movement's philosophy had its roots starting from the Meiji restoration and the effects of Westernisation and modernisation to the country, spanning four generations of history:

- The first generation founded the modernisation and Westernisation movement in the country. These influences led to the replacement of traditional apprenticeship systems with a modern educational system in Japanese architecture through founding a national engineering school. Through mimicking traditional European architectural styles such as Baroque and Renaissance in designing banks and national buildings without any alterations, the architects from this generation advocated "the true modern Japanese architectural style was the Renaissance, the Baroque, or whatever other style they were copying" (Kurokawa, 1977).
- The second generation oversaw the development of the effective accomplishment of an industrial revolution in Japan, beginning from the Old Liberalism more commonly known as the Taisho Democracy from 1912 to 1926, to the spread of jingoism or xenophobia and finally to the Second World War and its end in defeat. Architects from this generation attempted to incorporate traditional Japanese architectural styles into Western ones, and the Second World War boosted the development of ultra-nationalistic architecture as a symbol of Japanese authority. The end of the war spelled the end for the country's ultra-nationalistic architecture (Kurokawa, 1977).

Figure 20. A plan for Tokyo by Kenzo Tange in Tokyo Bay, Japan. 1960.





- The third generation witnessed the end of ultra-nationalism and the ruin of national self-confidence caused by the war, leading to re-evaluating the legitimacy of recklessly mimicking imported architectural styles. Architects from this generation “created a special world for themselves because they began their truly creative work only after the end of World War II, and were able to respond to the changes wrought in architectural style” (Kurokawa, 1977).
- The fourth generation’s “point of origin is the defeat and destruction in the war”. Sometimes referred to as the *Charred Ruins School* and the first generation taught under the completely new post-war system, all the architects of this generation have the traumatic images of events that occurred in their childhood: “the sudden, tragic destruction of Hiroshima and Nagasaki by atomic bombs and the virtually total reduction of cities and buildings to ashes”. Their architectural models did not contain classical European architecture nor the ultra-nationalistic designs (Kurokawa, 1977).

Figure 21. Clusters in the sky by Arata Isozaki, 1962.



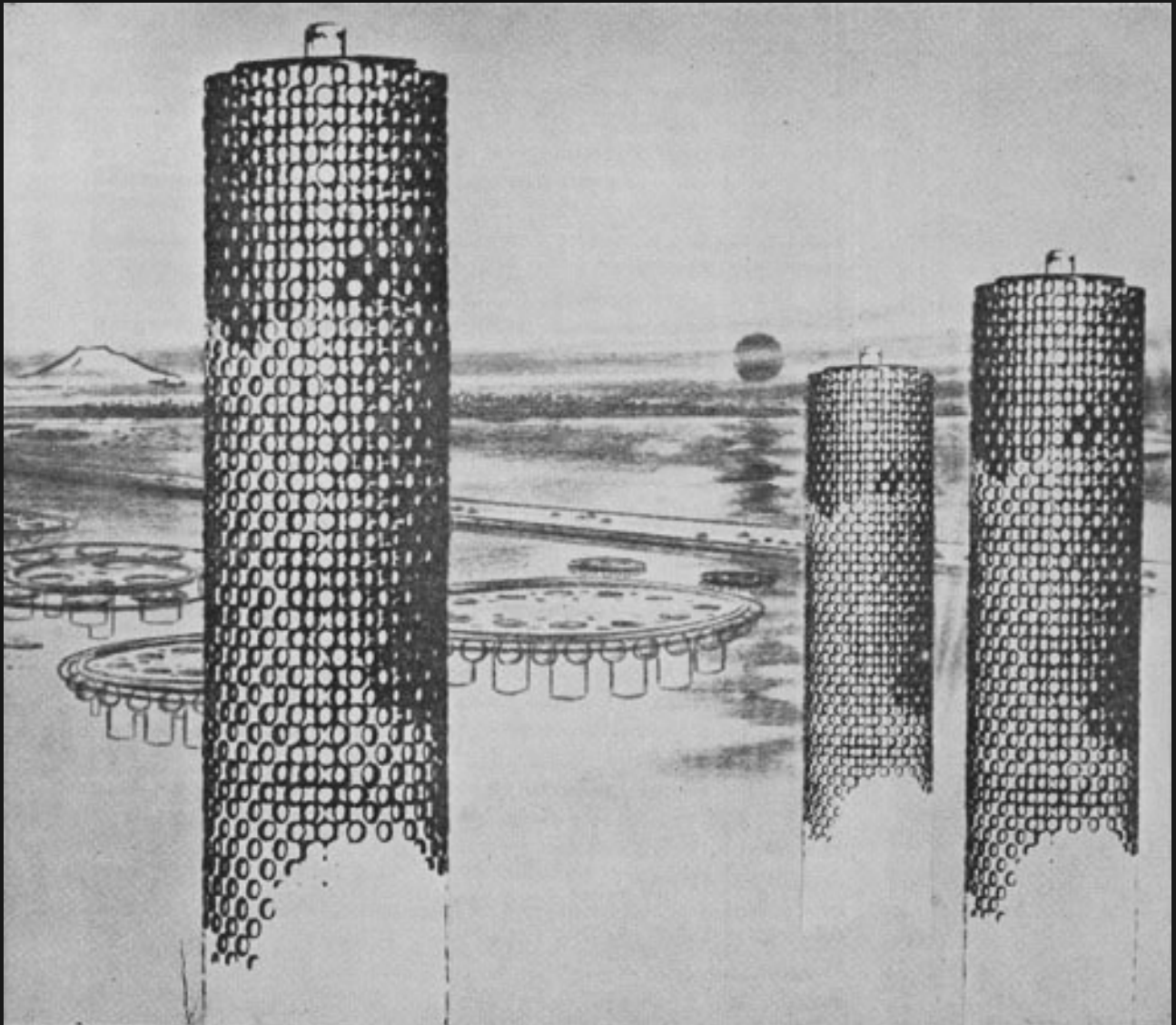
The group chose the biological word *metabolism* because they “believe design and technology should denote human vitality”. They do not believe metabolism only specifies acceptance of a natural, historical process, and they attempt to encourage the active metabolic development of the society through their proposals (Kurokawa, 1977).

The following concepts emphasise core traits of Metabolism’s philosophy:

- The architect’s job to formulate spatial equipment that allows the inhabitants to operate them. The population’s growth and age composition significantly affect the city’s character, residential types and the nature of architectural spaces. With the rapid population growth added into the mix, it is impossible to satisfy the demand for dwellings through conventional construction methods and may require assistance from technological progress. It is an architect’s duty to “help people master technology and strive to produce a system whereby changes occur as the result of human judgement” (Kurokawa, 1977). Applying this to the thesis will potentially generate an alternate future urban dwelling with uniform external and internal dimensions, but also have an iterative, customisable and interactive interior experience for the dweller.
- The possibilities for a new type of living space defined by mobility. The urbanisation of Japan coincided with the country’s modernisation. With rapid population growth happening within the major cities, combined with the country’s rapid economic growth, these urban areas encountered the issue in transportation and information-communications networks. There was a requirement to develop more efficient and swift circulation within the cities to maintain the economic stability of the country (Kurokawa, 1977). If this were to be adapted into the thesis, it is more effective to restructure the circulation first before using it as the template for development, and it will provide an effective and more efficient future urban area rather than developing future urban dwellings based on the existing circulation of an urban area.

Figure 22. Takara Beutilion Pavilion at Japan’s Expo ‘70 by Kisho Kurokawa in Osaka, Japan. 1970.







- The application of the metabolic cycle theory as a method to restore the identity of architectural space as part of humanity. The rapid economic growth in industrial Japan promoted the development of technology more complicated than previously known, leading to the potential development of technologically regenerative architecture (Kurokawa, 1977). This opens up opportunities to develop human controlled fixed and alterable spaces with the capability of breaking down and recomposing. These forms of living spaces already exist with the popularisation of prefabrication and modular designs. These technologies are most definitely a key factor in the development of future urban living, although in order to fully utilise them, it is important to think about how they can be applied not only to the manufacturing of the dwellings but the end of the dwelling's life cycle and potential regeneration.
- The importance of the materials used for the building components. Typical Japanese architecture solely relied on wood for its material for construction, much in contrast with the use of stone in Western architecture. Not only was this due to the abundance of the material in the country, but also due to their consciousness that "the materials themselves have a sense of eternity" (Kurokawa, 1977). The importance of using the right materials for the right design establishes the continuity between the buildings and the immediate environment, something that will help with the development of future urban dwellings. The Japanese also had aesthetic fondness for the plain, unadorned, natural, rustic, and slightly sad, relating to their sense of value (Idem). Aesthetics of metabolism is not restricted to how the material and its properties dictate the overall experience within the space, but rather it provides the canvas for the inhabitants to express themselves through contribution. When developing Western interior spaces, materials have always dictated the atmosphere of the space (Idem). This tends to inhibit the inhabitant's own personality and creates an atmospheric discord that can affect the inhabitant's wellbeing, something that is not ideal when living in an urban area. Allowing broad customisation for the inhabitant and using materials that convey the inhabitant-made atmosphere will define the level of comfort for alternate future urban dwellings.

Figure 23. An initial sketch of the Marine City by Kiyonori Kikutake. 1963.



- The acknowledgement of the principles of the metabolic cycle, that architecture must change with time, of interchangeability and replaceability, and that architecture, cities and humanity are transient – all originate from the group's personal experience of losing something important to them (Kurokawa, 1977). Accepting the fact that nothing lasts forever and anything can be rebuilt solidifies the groundwork for regenerative architecture that can withstand anything without necessarily retaining its original form. If this concept were to be translated into the thesis, it opens up the possibility of not only future regenerative architecture, but also a future regenerative city, and to a broader extent a future regenerative metropolis.

Metabolic architecture is another main source of reference for the thesis, especially for the formation of the design methodology and influencing the experimentation process as well. Perhaps the most noteworthy outtake from the movement was their perception of technology as an extension of humanity.



## Humanity`s Extension

According to Kisho Kurokawa, a member of the movement, there are two main elements that denote the belief behind the Metabolist Movement:

*It reflects our feelings that human society must be regarded as one part of a continuous natural entity that includes all animals and plants,... It expresses our belief that technology is an extension of humanity. This belief contrasts with the Western belief that modernisation is a repetition of a conflict between technology and humanity (Kurokawa, 1977).*

Based on Kurokawa's explanation, the importance of utilising technology is the key factor of the entire Metabolist movement—focusing not on how technology can help humanity but rather how humanity can utilise the technology to help itself. In design for an alternate future urban dwelling using technology, it is important to note that having a technology filled dwelling does not provide a solution to the issues stated by the thesis. Only through the interactive relationship between technology, inhabitant, and architecture may such a solution form.

In general, Metabolic architecture possibly commenced the normalisation of regenerative architecture in future architectural design, which in turn possibly influenced the expected approach architects must engage. Based on this mentality, the thesis intends to produce and develop an alternative to urban minimal dwellings in the future, all within the set aims and objectives of the thesis. Similar to how it assisted the Metabolist movement in generating concepts, emergent technology will also play an integral role in the overall development of this thesis.

Figure 24. Nakagin Capsule Tower stylised into Nihon-noir.





## 2.3 EMERGENT TECHNOLOGY

From the invention of the wheel, humanity has continued to strive and improve the tools necessary for it to survive and, potentially, evolve even further.

Often referred to as the technology with the potential to alter the status quo, emergent technology is the term used to describe normally new and old technical innovations representing progressive developments within a discipline for competitive advantage. Emergent technology is often involved in controversy and comparatively undeveloped potential, which can lead to the suppression and discreditation of the technology (Conway, 2013). Emergent technology's most notable impact lies in the future. The uncertain and ambiguous emergence phase is what determines its overall potential in the future.

Several emergent technologies are already present within the field of architecture and shaping its future. Some examples of emergent technologies within architecture are 3D printing, domed cities, and virtual and augmented reality.





3D printing involves printing three-dimensional objects in a single sitting made from a mouldable material. It is becoming more popular due to the convenience it offers for construction and architecture modelling. Being able to print any component made of a single material and potentially omitting the assembly process results in time-saving and cheap construction. Some downsides involving 3D printing in construction and architecture are the fact that the entire time-saving concept relies on the 3D printing, the limited material available for 3D printing, and the overall look of a 3D printed building. 3D printers are expensive to buy and require constant maintenance, not to mention the expensive repair cost if and when it breaks down. So far, the most successful 3D printing construction material is concrete, which is strong, cheap and easy to work with; however, the 3D printing process involves "slicing the shape into a large number of horizontal layers" ("3D Printed Building Construction," n.d.) built from the bottom until the layering process reaches the topmost part of the form. The end aesthetic of 3D printed buildings does not look pleasant most of the time since the walls are rough, flat and unfinished. Using 3D printing for the development of alternate future urban dwellings is most definitely an enticing idea, although the current version of the technology could potentially become non-existent due to the potential development of better methods for 3D printing.

Figure 25. 3D printing a four bedroom house.



Domed cities, branded as Biospheres, are large urban areas encircled under a single roof. Heavily inspired by science fiction stories such as *The Machine Stops* by E. M. Foster and Arthur C. Clarke's *The City and the Stars*, these structures were "originally conceived and built as a sealed environment for the purpose of determining whether a closed ecological system could sustain human beings for long time periods" (Space Science, 2002). With the recent development of self-sustaining technology, domed cities are being considered as potential suitable habitats for humans living outside Earth and in other inhospitable environments. The structural capabilities of the domed cities provide an interesting potential for the structure of the alternate future urban dwellings as well as the frames that will support them.

Figure 26. Eden Project  
Biomes by Exploration  
Architecture.





Virtual and augmented reality, most commonly referred to as VR and AR respectively, are the most recent trends and advancement in technology that have generated a large impact within society today. VR, technically, is “the term used to describe a three-dimensional, computer generated environment which can be explored and interacted with by a person”, who then “becomes part of this virtual world or is immersed within this environment and whilst there, is able to manipulate objects or perform a series of actions” (“What is Virtual Reality?,” 2017). AR, on the other hand, is “the blending of interactive digital elements – like dazzling visual overlays, buzzy haptic feedback, or other sensory projections – into our real-world environments” (Bonsor & Chandler, 2001). Both technologies are already shaping the field of architecture through their use in 3D modelling and presentations; however, we are only scratching the surface of what are two of the most influential technological feats within the last 50 years. These technologies will not only dictate how future urban dwelling will be formed, but will also control future urban living itself.

Figure 27. A scene from the short film *Hyper-Reality* by Keiichi Matsuda. 2016.

Emergent technology is a main reference point that may influence the design development of the proposed design. This may be due to technologies influencing all aspects of humanity, potentially dictating the future physical and living state of metropolises and other urban areas.





## Technology`s Influences

New technology may be developed due to humanity's desire to improve lifestyles, to pioneer uncharted domains and to prolong humanity itself. The application of technology in architecture potentially developed the methods of creating form and experimenting with concepts previously conceived as unbuildable.

It can be speculated that design through using technology allows for manipulation of form, structure and aesthetics, while designing through the influence of technology allows for the reinterpretation of conventional design and construction methods. By applying this philosophy as a method of developing future urban dwellings, multiple potential solutions may and will arise.

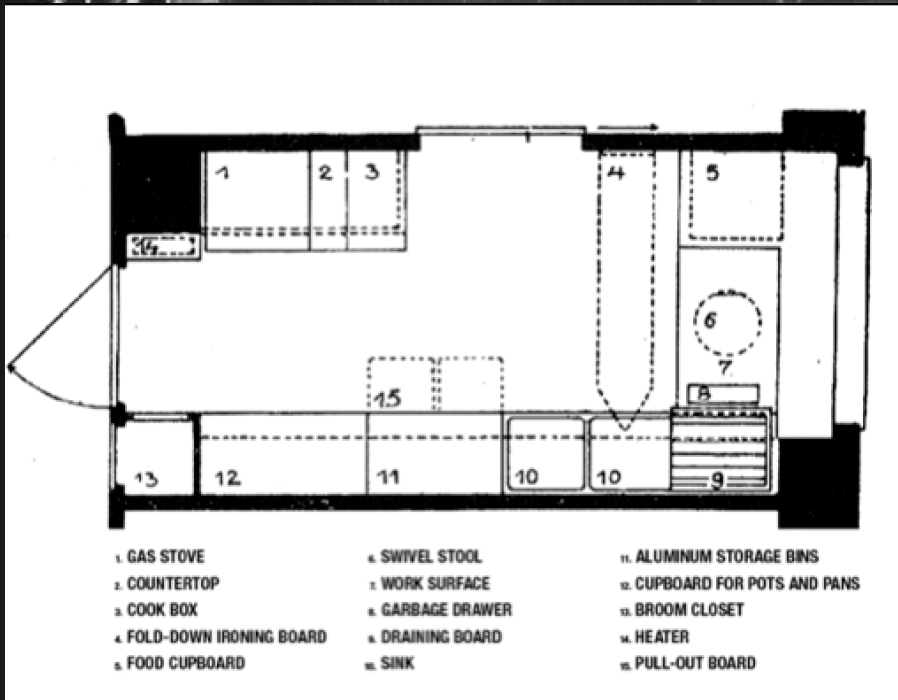
Overall, emergent technology opens the possibility of influencing design generation based on any technology present now and in the future. As a main reference for this thesis, emergent technology will influence the design methodology and the design development of the proposed alternative to urban minimal dwelling in the future. It also intends to incorporate the emergent technologies influencing the design within the designs itself.

Figure 28. An visual summarisation of a smart home utilising new texhnology.



## 2.4 EXISTENZMINIMUM

The systematic study about minimum housing began in earnest over one hundred years ago. Different from other styles in architecture history, Modern Architecture as a movement and as a platform for design and study, was chosen instead of cathedrals and palaces as the main theme for the common house. After the inaugural meeting in 1928, the *Congrès Internationaux d'Architecture Moderne's* (International Congress of Modern Architecture, CIAM) next meeting was in Frankfurt am Main with its main theme about minimal dwelling (Benevolo, 1971). It was in this CIAM (1929) that the concept of *existenzminimum* was first formulated and started an entire area of architectural study. *Existenzminimum* can be interpreted as the minimal existence, or as a field of study. Its question about what are the minimal conditions necessary for a healthy living led to fantastic studies about minimal and/or ideal dimensions of mostly everything; from the height of a chair to work versus a chair to sit leisurely, to mapping the work done in home kitchens, to the dimensions of pedestrian circulation within buildings and in the city (Julier, 2005).



Le Corbusier and Pierre Jeanneret wrote a report for the 2nd CIAM titled *Analysis of the fundamental elements of the problem of "The Minimum House"*, published in Corbusier's 1933 *The Radiant City*, (Le Corbusier, 1967), where they developed the basis of modern thinking about the minimal conditions a house should have (Idem). Apart from the pragmatic five points, Le Corbusier and Jeanneret argue that we should consider not only the house as a construction but also how we use the spaces and furnishings (Idem). They wrote:

*We must find and apply new methods, clear methods allowing us to work out useful plans for the home, lending themselves naturally to standardisation, industrialisation, Taylorisation.*

*If we do not sort out two independent events: the arrangement and furnishing of the home, on the one hand, and the construction of the house, on the other; if we do not differentiate between two unrelated functions: an organised system of circulation, on the one hand, and a system of structure, on the other; if we persist in the present methods by which the two functions are mingled and interdependent, then we will remain petrified in the same immobility:*

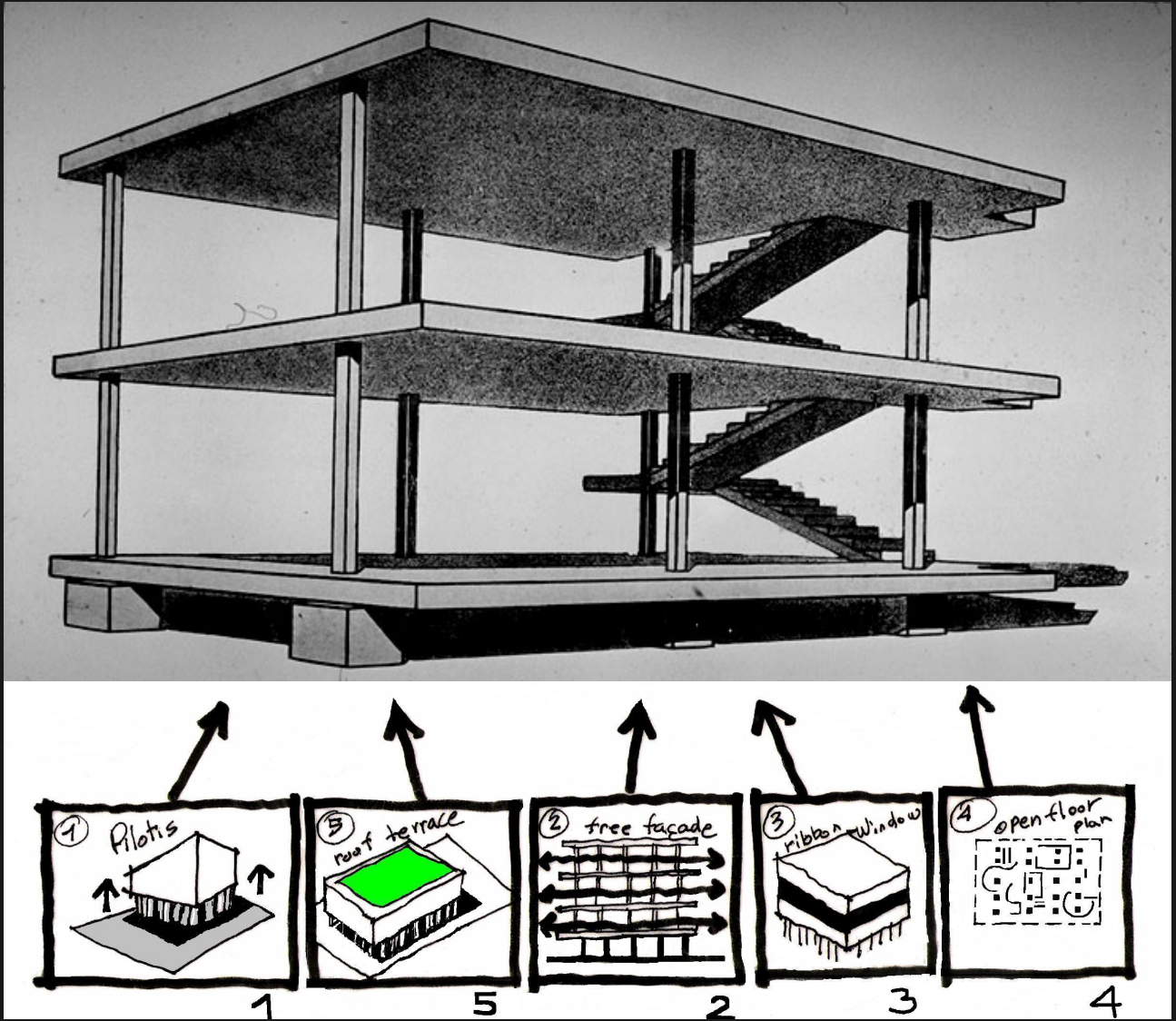
*a) Industry will not be able to take over the "Minimum House" and contribute its prodigious resources to the general economy.*

*b) Architecture will not be able to make plans adapted to the modern economy, and society, although it is in the process of regeneration, will be deprived of the "Minimum House" (Le Corbusier, 1967).*

Le Corbusier and Jeanneret also emphasised the role of circulation in architectural planning to maximise the flow between spaces and between interior and exterior. The idea is to use circulation together with furnishings to establish a narrative in a home (Idem).

Figure 29. Frankfurt  
Kitchen by Frau Grete  
Lihotsky. 1926.

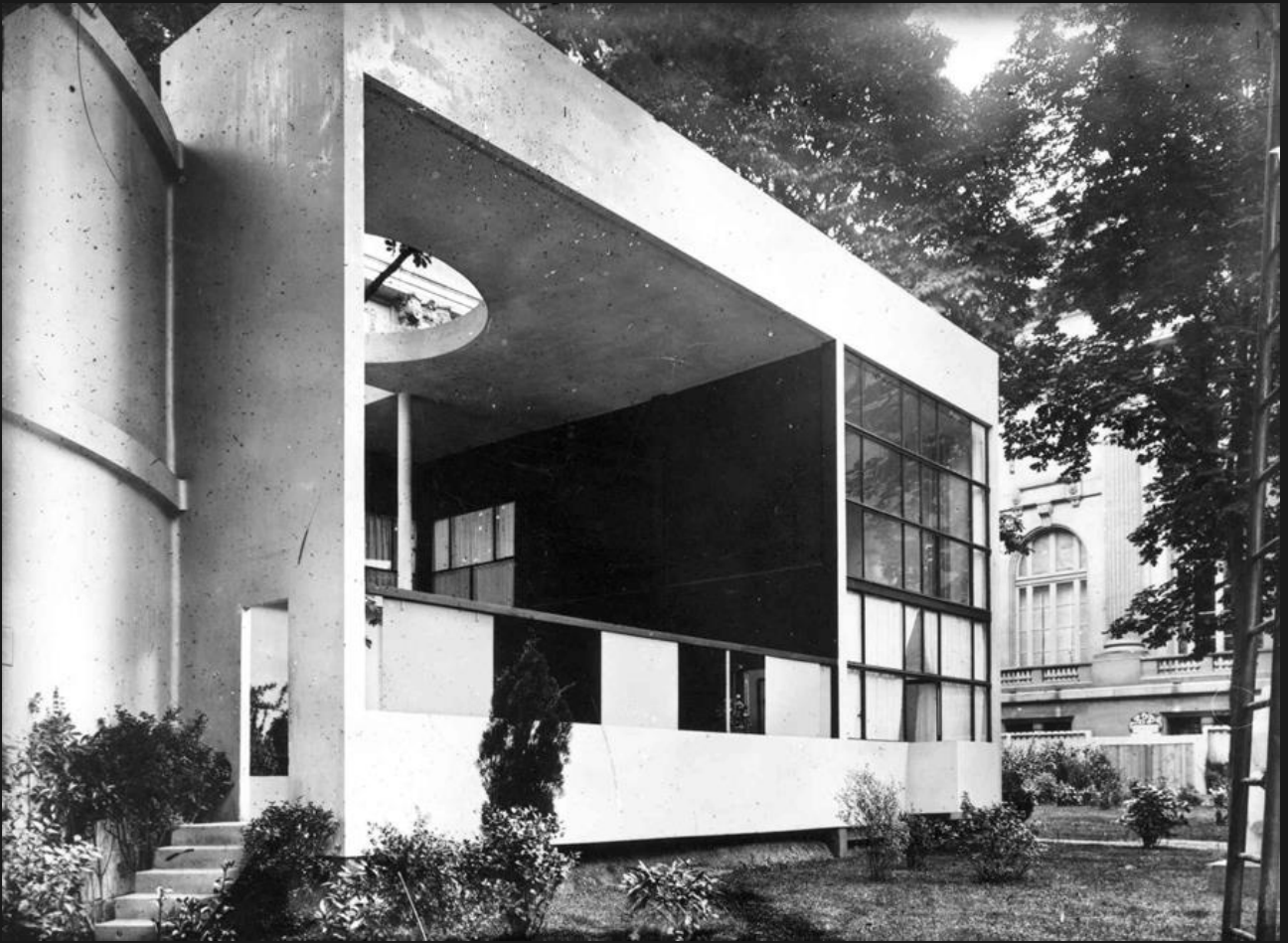




The requirements to achieve a good life standard with the minimal conditions proposed by Le Corbusier and Jeanneret could be summarised as follows:

- A minimum 'container', sufficient for the human scale with room to allow the basic functions of a house: sleep, eat, service (toilet and shower), entertain and leisure.
- The idea of comfort could be determined by thermal, light and acoustic measurements.
- An independent building structure that provides free, light-providing façades, and an open plan floor carried independently of the façade.
- A normalised standard measurement of equipment to be used for all types of dwellings.
- A rooftop garden to provide horizontal surfaces for urban dwellers amongst urban landscape's vertical layout.
- The use of pilotis to elevate the foundation of the house allowing free-flowing circulation on the ground level (Julier, 2005; Le Corbusier, 1967).

Figures 30 and 31. Le Corbusier's Maison Domino and his five points of architecture. 1915.

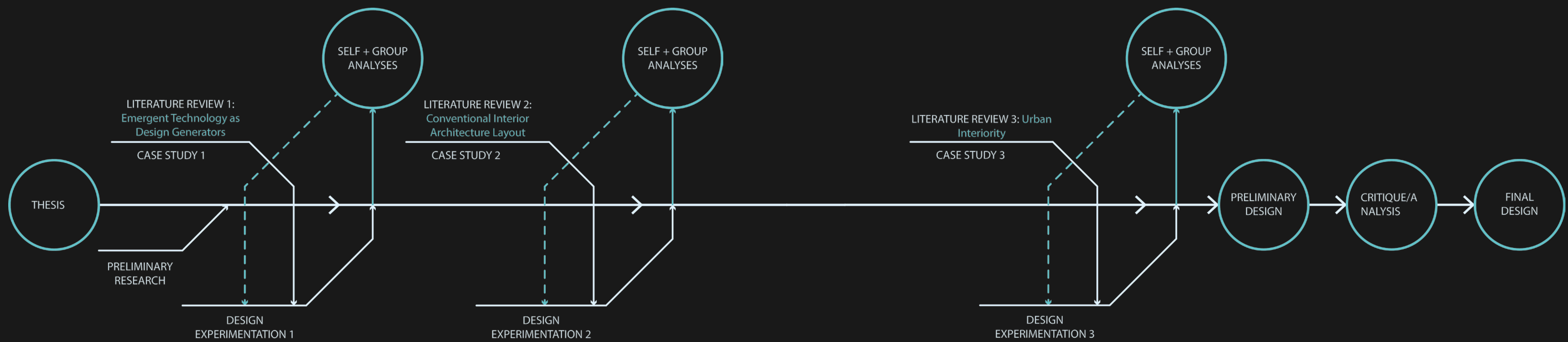


The idea of *existenzminimum* through the century became a motto that was applied not only to house design, but to airplanes, semi-trucks, recreational vehicles and even space stations. The minimal requirements for a good inhabitation became even more compact but not necessarily worse. If we apply the concept of *existenzminimum* together with the technology already in use, we can achieve a significant reduction of the size of the minimal housing with the maximum comfort possible. For instance, the pleasure of a great shower is not necessarily related to space. In the Airbus A380, the first-class passengers share a shower – called spa, in the air – which is probably the maximum of luxury (Smith, 2015). If the same principles of minimal, efficient and high-tech were to be applied to build bathroom kits for minimal housing, one could experience the same pleasure on land.

The idea of subsistence levels of living transformed from standardisation of ‘function spaces’ dimensions to provide easy access and use, to the most minimal space possible for a function space while providing the user an acceptable level of comfort. The shift in mentality indicates the priorities set by the inhabitants, implying that adapting to a space is more suitable and accomplishable now than it was during the initial start of the *existenzminimum*.

Fully expanding on the spatial refinement of *existenzminimum* requires finding the dimensional threshold required for a function and its inhabiting space, as well as the threshold required to provide an inhabitant with the appropriate level of comfort.

Figures 32. Pavillon de l’Esprit Nouveau by Le Corbusier in Paris, France. 1924.



Figures 33. Methodology diagram of the thesis.





## 2.5 METHODOLOGY

After analysing of each key theme and determining how each will aid the development of the thesis, the methodology for the thesis became apparent. The thesis is divided into two phases, the research phase and the design phase.

The research phase consists of the preliminary research leading to the composition of the thesis, literature review of texts and media deemed relevant to the thesis, and case study analysis. The preliminary research contains the initial knowledge that built up the thesis's core. The literature reviews are categorised based on the thesis's aims and objectives:

- Emergent Technology as Design Generating Tools,
- Conventional Interior Architecture Layout
- Urban Interiority

The case studies analysis also occurs alongside the literature review process. After both processes are completed, design experimentation is performed based on both. Once the experimentation yields a result, these are then critically analysed both personally and along with fellow thesis cohorts. If the results prove inconclusive, the experimentation resumes and will only stop once the yielded results undergo re-analysis until the results are considered satisfactory. The review process, design experimentation, and self and group analysis occur for each of the categories. After all the categories garnered satisfactory results, the design phase begins.

The design phase consists of the results for the categories including the design experimentations, the preliminary design, analyses from multiple critique panels, and finally the final design and its conclusion.





## CHAPTER THREE

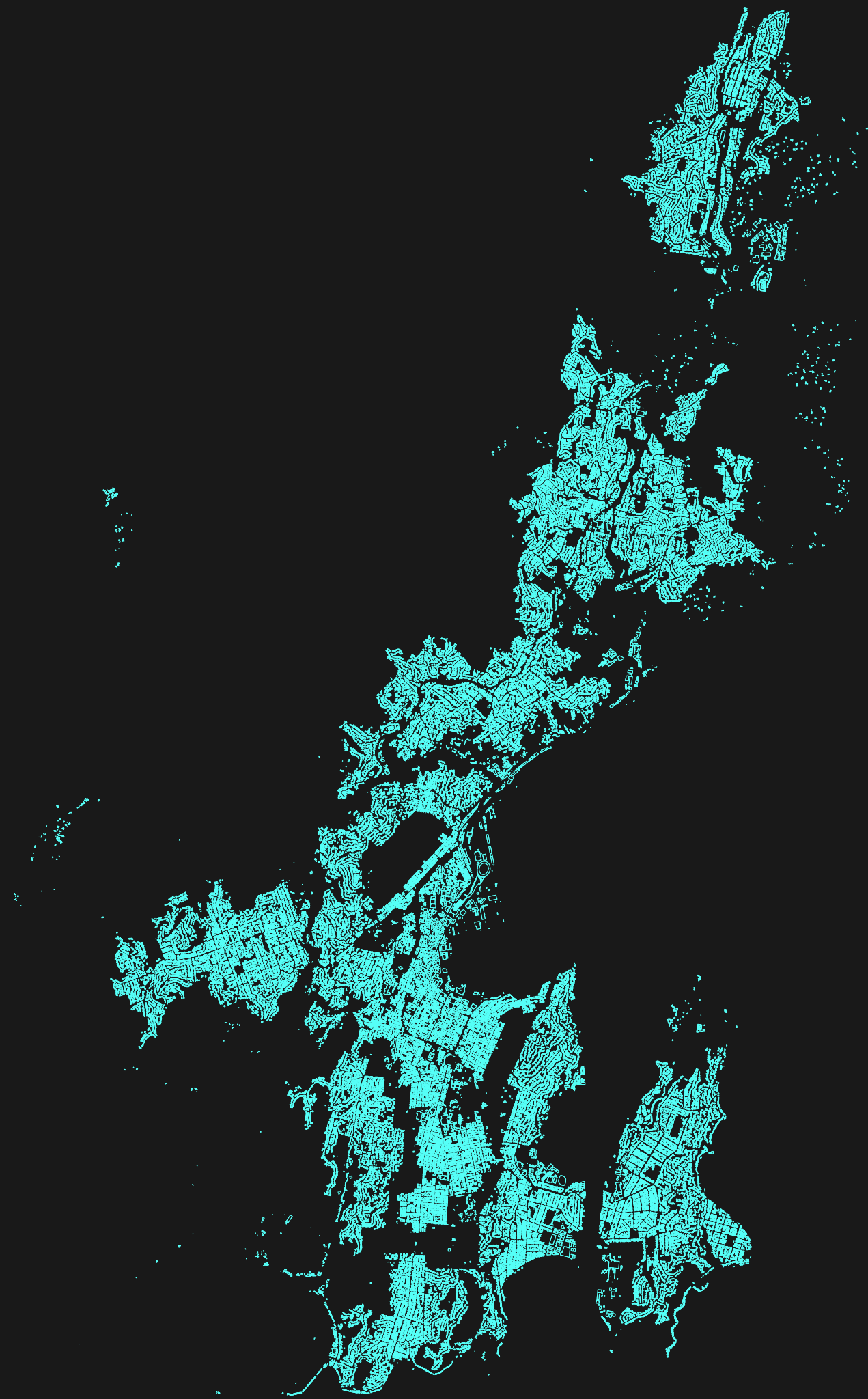
AN URBAN CENTRE,  
PRESENT AND FUTURE





This chapter introduces the selected site, Cuba Street in Wellington, New Zealand, for the thesis and explains the rationale that brought about the selection of the site. It aims to clarify the current conditions the site and the aftermath the site will experience after the implementation of the proposed alternate future urban dwelling.

This chapter is arranged to deliver a detailed understanding of the site at its current state, the urban living issues that will occur on the site that will force its revitalisation, and the state of the site once the revitalisation is implemented. Following the prior condition is what transpires on site once the proposed future alternate urban dwelling design is applied and how this will affect future urban living as a whole. This involves detailing future urban living issues that will influence the site.







### 3.1 CUBA STREET, PRESENT DAY

One of the most famous streets known for its history and diversity, Cuba Street in Wellington, New Zealand, is a slightly narrow two-lane street with pedestrian only segments between Manners and Ghuznee Streets. Filled with an assortment of different stores and establishments, it is Wellington's very own slice of bohemia ("New Zealand's coolest street," n.d.). It offers the city dwellers a place of culinary and creative soul within the professional and monotonous life within the city.

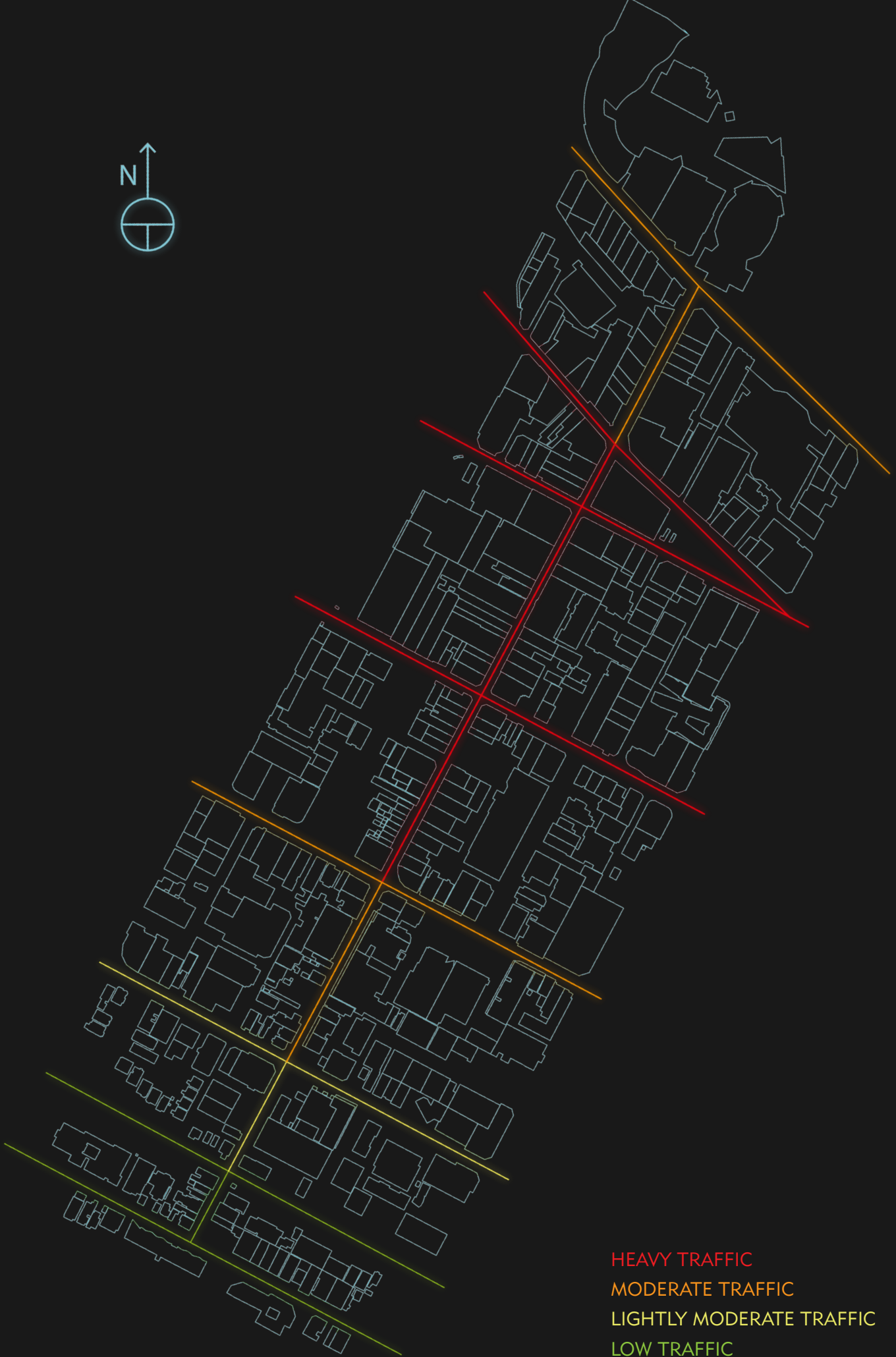
With the variety of stores present within the entirety of the street, the cultural diversity of Cuba Street reflects the number of people not only manning the establishments but also the people that visit them and the people that walk along the street. From the restaurants with different types of cuisines including Chinese, Malaysian, Thai, Vietnamese, Japanese, Indian, Pakistani, Italian, Argentinian, Mexican, and most importantly 'traditional and modern' New Zealand cuisine, to the cafes that define New Zealand's interesting caffeine culture ("New Zealand's coolest street," n.d.), to the pubs and bars that light up the evening life of the urban dwellers on most nights, to the different retail stores that cater to an individual's wants and needs, the street is always bustling with people from morning until late in the evening every single day.

Cuba Street is home to over forty heritage buildings, which reflects the history of the street. Several of these buildings have undergone or are currently undergoing earthquake strengthening in order to preserve them ("Cuba Street has time on its side," n.d.). Considering the historical value of this street, it is highly unlikely that Cuba Street will be easily forgotten or abandoned in the future due to damages caused by earthquakes. At the very least, the street would experience preservation by retaining and refurbishing the remaining façades of the buildings and leaving cavities behind the façade for redevelopment.

Figure 35. Cuba Street during a non-busy day.

Figure 36. Bucket fountain in Cuba Street





HEAVY TRAFFIC  
MODERATE TRAFFIC  
LIGHTLY MODERATE TRAFFIC  
LOW TRAFFIC

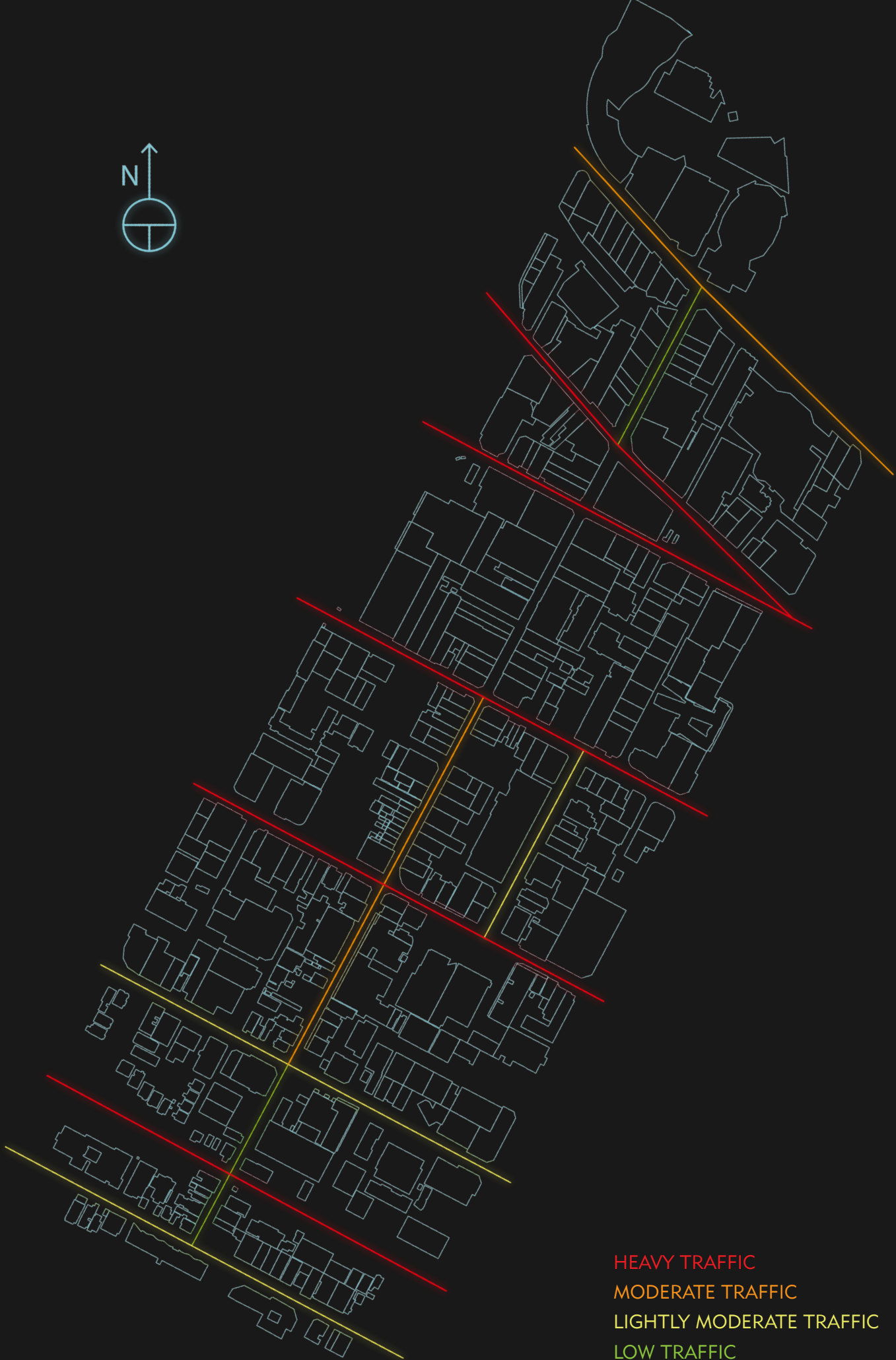


With over twelve different intersecting streets, Cuba Street is an extremely busy street in terms of its circulation. The entire street is accessible by pedestrians and vehicles, with the exception of the sections between Ghuznee Street, Dixon Street and Manners Street since the pedestrian mall "Cuba Mall" is situated in these sections. Much like any other busy streets in any city, the street's circulation varies in each intersection for both pedestrians and vehicles. The following site circulation analyses illustrate the average weekly street traffic for pedestrians and vehicles.

### **Cuba Street`s Pedestrian Traffic**

Heavy pedestrian traffic occurs most of the time in the intersections of Ghuznee Street, Dixon Street and Manners Street since these are the entryways of Cuba Mall. Moderate pedestrian traffic occurs in the intersections of Vivian Street and Wakefield Street for different reasons. The pedestrian traffic in the Vivian Street intersection occurs from morning until early evening due to the students heading to and from the Victoria University of Wellington Te Aro Campus as well as people heading to and from Cuba Mall from Vivian Street, while the pedestrian traffic in Wakefield Street occurs during the afternoon and in the weekend since the route leads straight to the Waterfront and hosts the Wellington Night Market on Saturdays. The Abel Smith Street intersection has a lightly moderate pedestrian traffic since pedestrians mostly pass by coming from Cuba Mall and people living in the Mount Cook suburb. Pedestrian traffic does pick up during the weekends due to the well-known restaurants and cafes around this part of Cuba Street like Fidel's and Southern Cross Garden Bar. The State Highway 1 and Webb Street intersections have the lowest pedestrian traffic since these sections often contain residential buildings and some office buildings. Ordinary pedestrians would not visit these sections unless they have some form of business involving these establishments.

Figure 37. An analysis diagram of the weekly pedestrian traffic in current Cuba Street.



HEAVY TRAFFIC  
MODERATE TRAFFIC  
LIGHTLY MODERATE TRAFFIC  
LOW TRAFFIC

## Cuba Street`s Vehicular Traffic

Although no heavy vehicular traffic directly occurs in Cuba Street, heavy vehicular traffic does occur on five different streets intersecting it: Manners Street, Dixon Street, Ghuznee Street, Vivian Street, and the State Highway 1. Manners Street and Ghuznee Street are bus routes, with Ghuznee leading to both the Kelburn suburb and the Wellington Train Station while Manners Street is a bus only route coming to and from the train station. All six streets intersect with Victoria Street and Willis Street, which are two streets that experience heavy vehicular traffic almost every day. Vivian Street is another exit for vehicles coming from the State Highway 1 and is a direct route leading to the Victoria Tunnel after intersecting Cambridge Terrace and Kent Terrace. Dixon Street is the only direct non-exclusive route to Victoria Street and Willis Street exiting from Courtenay Place. Moderate vehicular traffic occurs at the Vivian Street intersection and Wakefield Street since they connect with streets with heavy vehicular traffic—Vivian Street and Ghuznee Street for one and Jervois Quay, Cable Street and Cambridge Terrace for the other. Lightly moderate vehicular traffic occurs on Webb Street, Abel Smith Street and Marion Street. These sections are commonly used as alternate exits and routes when the heavy vehicular traffic streets congest, often occurring in the early morning, midday and late afternoon during the weekdays and all day during the weekends. Low vehicular traffic occurs at the State Highway 1 and Wakefield Street intersections for various reasons. Vehicles only use the Highway intersection if they wish to enter the highway from Webb Street or Abel Smith Street, but since both streets connect to Taranaki Street, Willis Street and Victoria Street, fewer vehicles use these routes. On the other hand, the Wakefield Street intersection experiences almost no activity at all, most likely because it looks more like a pedestrian-only street and the Wellington Night Market is held here every Saturday.

Figure 38. An analysis diagram of the vehicular traffic in current Cuba Street.



As mentioned earlier, Cuba Street contains over forty heritage buildings built during the mid-1800s. Aside from these buildings, modern buildings populate the majority of the street as well. Most of these modern buildings are situated around the ends of Cuba Mall and between the State Highway 1 and Vivian Street, mostly housing offices and clusters of retail stores. Most of the buildings are three storeys tall, with retail stores, restaurants, bars and cafes on the ground floor while the upper floors contain residential apartments. Taller buildings often have offices on the upper floors instead of residences.

Cuba Street's characteristics can be interpreted as a main factor that defines the identity of the site, not just its physiological characteristics. If any physical changes were to happen on this site in the future, whether large scale or small scale, Cuba Street as a place may be altered. But the place Cuba Street is (the identity in which it perceived) will remain the same since that aspect is defined by the inhabitants of Cuba Street.

Figure 39. Cuba Mall in 1960.

Figure 40. Cuba Street in 1910.



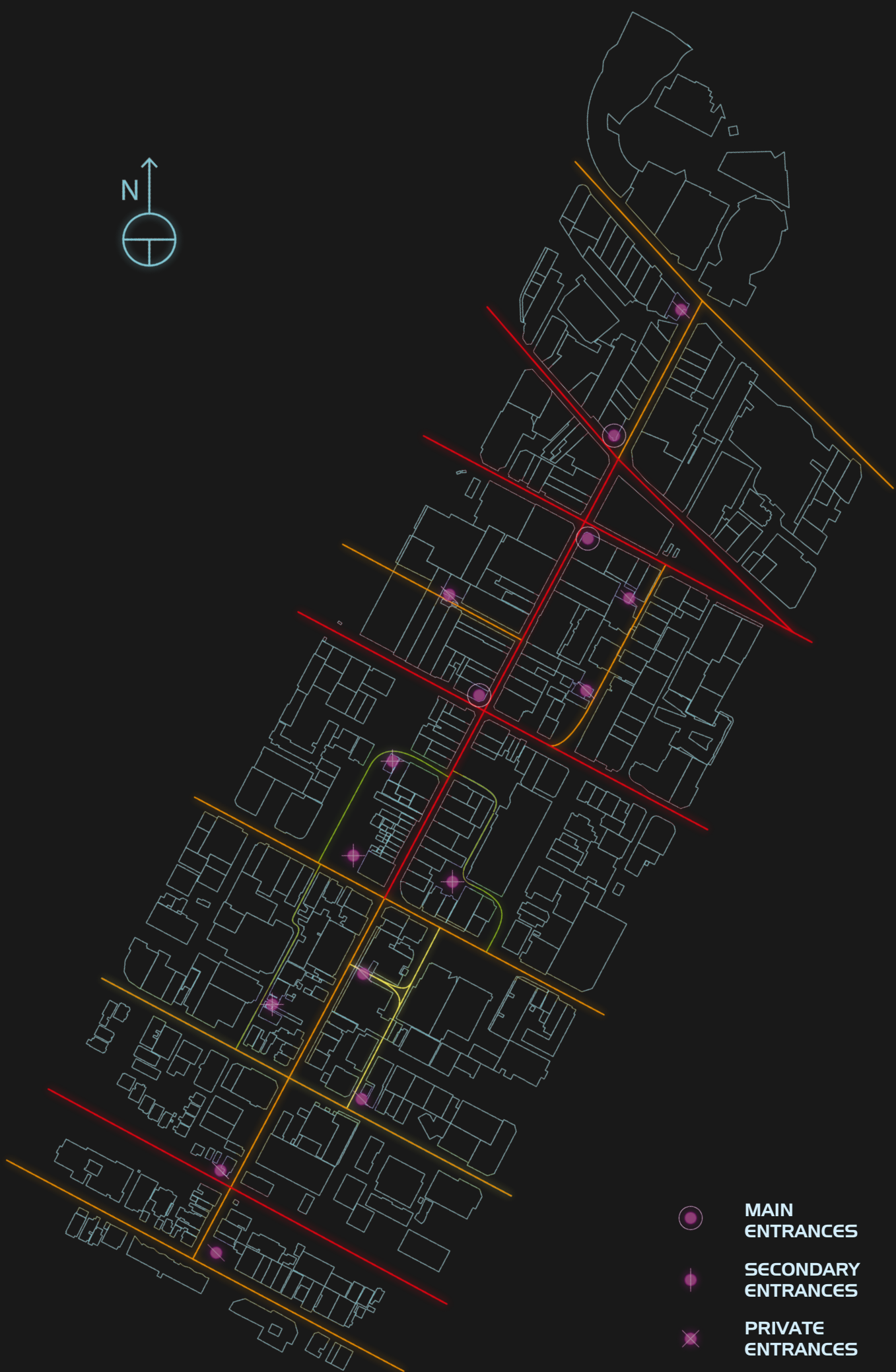


## 3.2 CUBA STREET, THE FUTURE

Although, geologically, a major earthquake in Wellington is inevitable, which will certainly alter the characteristics of the city, for this thesis I am considering that the main character of Cuba Street described above will remain. The identity of Cuba Street will remain the same even in the future; therefore any changes that may physically affect Cuba Street in the future will only alter its physical form. What does affect the identity of Cuba Street, however, are the urban living issues inherent in all urban areas and metropolises around the world.

Much like any major cities and metropolises around the globe, Wellington will continue to experience overpopulation within the CBD as a result of the reconstruction effort to rebuild Wellington. The selected site, Cuba Street, serves as the boundary between the residential and commercial sectors that contain development potential to rekindle the bohemian life within Wellington's centre.

Urban grid reconstruction involves altering the circulation and layout of buildings. In the thesis's universe, the future Wellington city centre undergoes this process, which results in the transformation of the streets within the city centre into pedestrian-only, allowing an omnidirectional circulation within the centre, relocation of streets that vehicles can use to the perimeter of the city centre, and an underground public transportation system with hub ports situated along its perimeter. These changes were applied to promote a better circulation for pedestrians and vehicles under the notion of *time is of the essence*. This concept affects every aspect of life. As life in an urban area places high priority on time in order to remain productive and prosperous, more productive time means more money. Conversely, less travel time means more quality time for work or rest.



- MAIN ENTRANCES
- SECONDARY ENTRANCES
- ✕ PRIVATE ENTRANCES

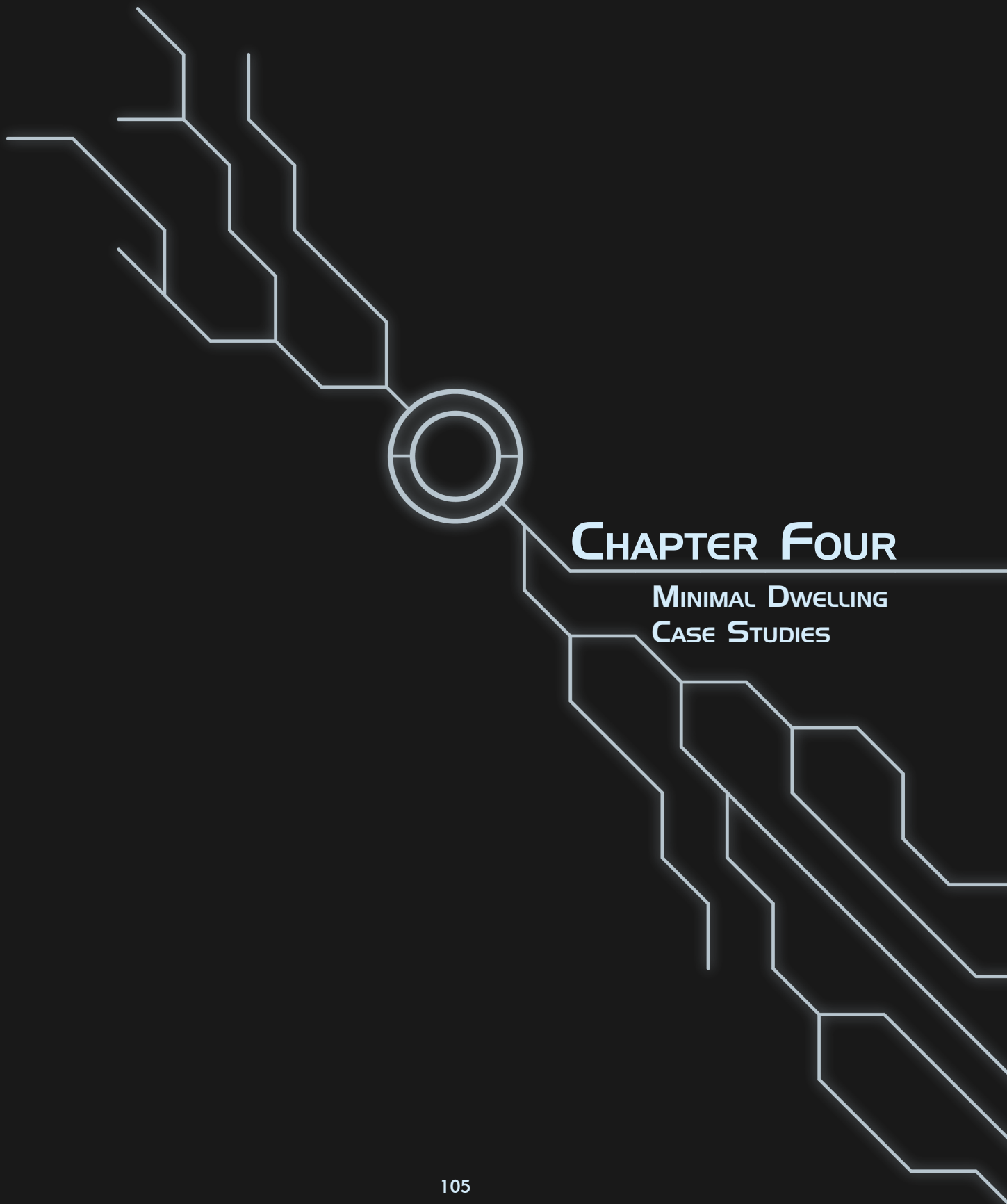
Placing the proposed alternate future urban dwellings in Cuba Street introduces a new circulation in the site. The entire site gains an increase in pedestrian traffic and opens up more pathways leading to and from it not commonly used before the reconstruction. Gaining more traffic and entrances requires more entryways leading to the proposed dwellings. With a total of fifteen entrances providing access to both site and proposed dwellings, these entrances are categorised into three different types.

- Three main entrances provide the general public access to the dwellings and are situated by Cuba Mall, which has the heaviest traffic out of the entire site. These entrances grant open access to the public from morning to early evening and become restricted for the residents only until the morning of the following day.
- Seven secondary entrances also provide general public access to the dwellings and are located around the intersections and pathways leading to the site. These entrances have the same operating period to the main entrances and serve as conveniences that allow the residents a more direct route to their dwellings.
- Five private entrances are located around the site with low pedestrian traffic. These entrances are restricted to the public and can only be accessed by the residents. The placement of these entrances is for privacy and convenience purposes since the pathways in which they are located are most often used as shortcuts to and out of Cuba Street.

Figure 41. An analysis diagram of the overall traffic for the proposed future Cuba Street.







## CHAPTER FOUR

MINIMAL DWELLING  
CASE STUDIES



In nearly a century, there have been countless designs all around the world that attempt to envision the concept of the minimal dwelling for the future. The following case studies are examples of distinct interior spaces with distinct atmosphere—interior spaces that express details such as urban necessities, their target users. They are interior spaces that investigate economic climate, societal conditions, technological functions, and quality of life. Consequently, they react correspondingly to typology of a minimal urban dwelling and exhibit its varying depictions.

One of the case studies responding to the inherent issue of overpopulation in a metropolis is the coffin and/or cage homes in Hong Kong, one of the densest metropolises in the world.



## 4.1 COFFIN/CAGE HOMES

### HONG KONG

In 2018, Hong Kong became the world's least affordable housing market in the world for nine consecutive years, with average costs at 19.7 times higher than the median annual household income (Bertaud, 2018). Hong Kong's housing issue has always been prevalent even before the region was returned to China. Although the common understanding of the cause of this over-inflated cost in housing market is the expensive land prices due to land scarcity within the region itself, the underlying cause of this issue is due to the poor land management and policies regarding the developed and undeveloped lands. Underdeveloped land is estimated to be 75% of the total land in Hong Kong (Vox, 2018).

In most urban areas of the region, hundreds of thousands choose to live in small, wardrobe-sized rooms within one apartment flat due to the insanely expensive property and utility costs. A common layout of these dwellings is a flat subdivided into several rooms no larger than a one-car garage. On average, four to six families live within one apartment, each renting out a room with only enough space to fit a single or bunk bed, a table, and a few of their belongings. The inhabitants of one apartment all share a communal kitchen and bathroom, all within one corner section of the apartment. Natural lighting and ventilation are only available to inhabitants with access to windows, making it uncomfortable for the rest of the inhabitants especially to those with poor health.

Figure 42. Subdivided flats in Hong Kong.





In some cases, an apartment may simply not have enough space to accommodate more tenants and would instead offer cage structures, or cage homes, to accommodate these people. These cage homes have the size of a single bed with only enough headroom to allow sitting and kneeling, with the space only enough to fit a single mattress and an inhabitant's small personal belongings. Stacked on top of other cage homes, this habitation scheme increases the inhabitant capacity of a common apartment layout from four to six families, with an average domestic household size of 2.8 person as of 2018 ("Table 005 : Statistics on Domestic Households," 2018), to easily over twenty individual inhabitants. The natural lighting and ventilation for these dwellings are as bad as the common apartment layout, since there is no even distribution because of typical window layouts. Another version of these cage homes is called the coffin home – coffin homes have the same fundamental characteristics as cage homes, except that the wall structure is solid, providing privacy to the inhabitant unlike the perforated cage walls of cage homes. This does, however, potentially further worsen the living conditions of the inhabitant – where natural lighting and ventilation are more restricted than cage homes, and inhabitants may feel more isolated than in cage homes.

The cage and coffin homes in Hong Kong can be considered as an extreme approach to minimal urban dwelling. This case study indeed addresses the inherent issues of modern metropolises – overpopulation and lack of affordable housing. It has also evidenced what the future urban living could appear as; however, this should not by any means be the future of urban living. Maximising the available interior space to allow more people to inhabit the space opens up new possibilities for potential layouts prioritising occupant capacity, much like capsule hotels. On the other hand, comfort is an important aspect of salubrious living, and these cage and coffin homes are far from comfortable. The user's experience is what defines a space's comfort. Although the inhabitants living in these dwellings chose to live in them, the cost of Hong Kong's housing market is what led them to their decisions. Should a larger dwelling be offered to them for the same price, or possibly even cheaper, the inhabitants would most definitely choose the larger dwelling rather than stay in their current one for its comfort and price. On another note, the cage and coffin homes do provide an interesting concept – having access to almost all functions and belongings by containing them within the same space. This concept opens up the possibility for cross-functionality and interchangeable services within the same space, similar to what was portrayed in Dallas Korben's apartment in Besson's *The Fifth Element*. Having cross-functional and interchangeable services reduces the necessary space size for two separate functions and combines them within one area. In any urban dwelling, space distribution for the inhabitants and their belongings can dictate the dwelling's comfort; if there's not enough space for the inhabitant to easily move around, not enough space to store the inhabitant's belongings, or both, then the living space is uncomfortable, consequently making it an insalubrious dwelling.

Figure 43. All-in-one kitchen, bathroom and laundry space.





Another form of these coffin or cage homes once existed within Kowloon Walled City in the Kowloon district. Historically, Kowloon was acquired by Britain during the 1860s as one of the ceded parts of Hong Kong from China, and the northern part was leased in 1898 for 99 years as part of the New Territories and became known as New Kowloon. However, within New Kowloon was Kowloon Walled City, a Chinese fort transformed city that was excluded from the cession and remained under China's governance. Although the British claimed ownership of the city, they provided little to no support to its inhabitants. With the complications regarding access to and from the city, the city also received no support from the Chinese government, resulting in Kowloon Walled city becoming a lawless and impoverished state. Without support from any government, the city's inhabitants only have themselves to rely upon, resulting in its haphazard structure and residents having to squat in small and deprived living quarters within derelict, codeless buildings. The British and Chinese governments eventually decided the demolition of Kowloon Walled City in 1987 and the Walled City was demolished in 1993, just before Kowloon and the rest of Hong Kong were returned to the People's Republic of China in 1997 ("Kowloon History - Culture, Religion and Lifestyle in Kowloon," n.d.; "Kowloon Walled City," 2012).

Each dwelling varied in size depending on the inhabiting family's size and was stacked on one another in a non-congruent layout. The dwellings were made from scrap materials found around the area built over the existing building structures in the city. The interior of each dwelling consisted of a space for eating, lounging and sleeping, and a wet area containing the kitchen and bathroom presumably to contain water within one place. Several dwellings within the inner part of the city were located within the courtyards of buildings, further reducing the already small amount of natural sunlight received by their inhabitants. The alleyways were also dark and littered with garbage, a sign of unsanitary conditions the inhabitants were forced to cope with as they go about their business. Inhabitants with businesses conducted their trades and sales within their dwellings; some had enough spare space for their businesses, while others converted their living spaces into stores and shops during the day and reverted them back afterwards. The rooftops were accessible by anyone, containing large amounts of television antennae and no guardrails on the edges, making it an extremely dangerous place since people, especially children, could accidentally fall off more than ten storeys to the ground. Although a dwelling appears to have the size of an average one-bedroom apartment, the inhabitants are not comprised of single people or couples but are typically families of four to six people on average instead. The unstable dwellings in Kowloon Walled City truly were minimal urban dwellings, with an unfortunate emphasis on the minimal standpoint.

Figure 44. A store and household space.





The dwellings in the Kowloon Walled City are a prime example of an insalubrious minimal urban dwelling. The codeless constructions within the city jeopardised their inhabitants with the structural instability of the dwellings. Aside from the dwellings, the potential sanitation and health issues caused by poor circulation and urban planning, and the security and safety within the walled city were considerable issues as well. The interchangeable space of the living room and business stores does provide an interesting approach to interchanging functions and services; however, it also invites sanitation and health risks to the inhabitants from businesses involving food service, grooming service, and sales of goods. The circulation within the city is also quite abysmal due to the dark, narrow and deep alleyways. Although traffic caused by vehicles was not an issue for the inhabitants, safety and security issues within the pedestrian paths were instead due to the lawlessness and the rampant criminal activity within the city. The dwellings themselves are statements about the urban issues of overpopulation, lack of affordable housing, and poor pedestrian circulation – the solution presented by the dwellings follows the basic principles of a minimal dwelling, with comfort as the least successful. The interior does not emit a comfortable atmosphere since the dwelling has an encumbered feeling to it. A person would not normally consider a dwelling made from leftover materials and built over unstable structures as comforting since the inhabitant's sense of danger overcomes them. One could say that the dwellings in Kowloon were affordable since the construction materials were abundant and construction time was minimal. The circulation leading to the dwellings is not ideal for an urban area for obvious reasons stated earlier. One aspect of the Kowloon Walled City dwellings that proved to have potential influence for the thesis was that each dwelling did not stack based on a predetermined grid, allowing for a somewhat organic growth for the arrangement. This opens the possibility of developing structures completely separate from the dwellings and thus permitting a more unrestrictive layout, creating an opportunity to situate the structures almost anywhere within the thesis's proposed site.

Figure 45. Coffin home interior.



Overall, this case study should be the outcome that this thesis must avoid at all cost. It does not portray the ideal alternate minimal urban dwelling the thesis seeks to accomplish, which includes comfort along with functionality. It provided insightful concepts that can develop not only the programme layout for the alternate future urban dwelling, but also the potential structural assembly for the proposed dwelling design. The case study also delivered key notes that will assist with the approach for the design, mostly on what to avoid and improve in future urban living.

In a sense, the Hong Kong coffin/cage homes could be considered as budget urban dwellings that can barely provide the necessary functions and spaces for inhabitants so that they may have comfortable and salubrious lives. This contrasts with the contented lifestyle amidst a metropolitan city centre offered by capsule hotels, which is something offered by the next case study, the Nakagin Capsule Hotel.



## 4.2 NAKAGIN CAPSULE TOWER

**KISHO KUROKAWA, 1972**  
**TOKYO, JAPAN**

Nestled within the heart of Japan's leading shopping district Ginza, the Nakagin Capsule Tower is a project developed by Metabolist Kisho Kurokawa in 1977 to provide single bedroom dwellings – “studios for businessmen living in distant suburbs of the city, or hotel spaces for businessmen staying in Tokyo for brief periods” (Kurokawa, 1977), or even ateliers for graphic designers and artists. Japan's post-war economic growth, due to the financial aid of the United States of America, saw the population decline in the country's metropolitan centres, resulting in the increase of commercial buildings and a decrease of housing all within the city centres. “No less than three million people travel an hour or longer to commute to work in Tokyo” (Idem), emphasising the importance of restoring dwellings to the city centres. This project was Kurokawa's strategic solution to provide short-term living space for people living in distant areas and constantly commuting to and from the city centre. The building was never intended to be leased as an apartment house since the Metabolism philosophy promotes a natural renewal of buildings, ergo the renewal of inhabitants occupying the space.

Figure 46. Nakagin Capsule Tower.





The Nakagin Capsule Tower consists of two main structural elements: two steel frame and reinforced concrete towers – one eleven and the other thirteen stories – housing elevators and equipment piping; and capsule rooms that were almost completely finished when attached to the towers (Kurokawa, 1977). The building, serving as both a hotel and sales apartment building, holds 144 capsule rooms in total, all independently cantilevered and connected to the structures through high suspension bolts to permit the easy removal of any capsules without affecting the rest along the process. An individual capsule cuboid has dimensions of 2.5m by 4m by 2.5m in size. The capsule's major structure is an all-welded, lightweight, steel-truss box similar to large shipping containers. The exterior cladding is galvanised, rib-reinforced steel panels coated with rust-preventive paint and a gloss spray (Idem). Although the capsules have a uniform design, their building is comprised of four structural types of capsules due to the varying layout. The capsule's interior is comprised of multiple pre-assembled parts pertaining to each of the specialised functions within – the living room, bedroom, kitchen, and so on. The furniture, utilities, television sets, interior fittings, and other interior components were assembled in a factory and fitted into the capsule's main structure. The interior contains the essential components required for a short-term dwelling, such as a bed and bedding, a storable desk, storage space for clothing, a bathroom with the necessary sanitary facilities, telephone and audio equipment, and service items such as blankets, towels and toothbrushes (Idem). A capsule can accommodate a maximum of two persons; however, it is more comfortable if only one person inhabits it. The interior space clearly translates the Metabolist aesthetic:

- The wooden internal walls, furniture, ceiling and floor advocate simplicity, backed up by different painted finishes applied to all surfaces thus creating a nice cohesive contrast between each interior element.
- The circular framed glass window complements the linear outlines of the interior, tying the whole interior into a somewhat seamless environment.
- The interior layout fully utilises the space provided by the capsule's main structure, creating a space that provides full access to all available.

Figure 47. Capsule interior.



The Nakagin Capsule Hotel can be considered as a more conventional approach to future urban living since many of the elements presented by the project have been adapted by recent design schemes for minimal urban dwellings. This case study addresses the inherent issues in metropolises that was the same even decades ago – overpopulation, poor urban circulation, and lack of urban dwellings within the city centre. Kurokawa’s approach to install a ready-made housing complex within a bustling city centre is an important benchmark to follow if it were to be applied to the thesis. By placing a housing building within a shopping district, it alters the existing circulation present on site, for better or worse. In order to improve the circulation, the alternate future urban dwelling must be located in parts of the site that can help promote and reinforce the existing utilities and programmes. This will ensure that neither the dwelling nor the site will experience severe congestion and/or lack of it. Another interesting notion the case study alluded to was the intent to design a uniform format for clients while retaining individuality. The capsule’s design was optimised specifically for business people, office workers, artists and graphic designers in need of temporary lodging. This method not only determines the potential form of the proposed alternate future urban dwelling, but also fastens an alternative format for urban dwellings. Prioritising a client’s needs over their wants is a principle every architect and designer must always adhere to. The use of prefabrication and assembly to mass produce living space is another aspect provided by this case study. Consumable dwellings may leave a sour impression since it highly plays with consumerism, a somewhat derogatory word that undeniably helped improve lives during times of global financial and economic crises. This concept does prove helpful for the thesis since conventional urban dwellings are hard to relocate, replace and remove, sometimes requiring a full demolition of an entire building, which in turn costs more time and money. It provides a structural system that can easily reduce, and potentially remove, the hassles of demolitions, relocation and reconstruction, and instigate a more affordable housing alternative for urban dwellers. Perhaps the negative aspect about prefabricated consumable dwellings is that they require constant maintenance. The Nakagin Capsule Tower, though it still looks fantastic, has not been properly maintained for over forty years and will potentially be demolished within the next ten years (Sveiven, 2`011). Prefabricated and preassembled dwellings require frequent maintenance to sustain a fully functional dwelling. An unmaintained dwelling will only result in an uncomfortable life for the inhabitant. Finally, the last point this case study offers is the experience provided by a capsule room. Unlike capsule hotels, another development by Kurokawa that prioritises the maximum capacity of a space by minimising the comfort, capsule rooms offer the necessary utilities and functions found in capsule hotels all within one room. Although the capacity ratio between the two alternatives may seem unproportioned, capsule rooms cater for a larger audience since it is highly advised that claustrophobic people not stay in capsule hotels.

Figure 48. Capsule interior and window.





All in all, this case study should be the bare minimum of what the thesis needs to achieve. It can already be considered an effective alternate urban dwelling for the present and even the future; however, this does not mean that this scheme cannot be improved. It provided insightful concepts that can develop the interior and exterior form of the proposed alternate future urban dwelling, and it delivered principles addressing the importance of a systematic and functional urban area.

While the *Nakagin Capsule Hotel* offered short term dwellings as a solution for Tokyo's issues of overpopulation and disadvantageous urban lifestyles, the final case study, the *OPod Tube Housing*, intends to provide the same form of living not as a solution, but as a stopgap.

Figure 49. The Nakagin Tower's current damages.



## 4.3 OPod TUBE HOUSING

### JAMES LAW CYBERTECTURE HONG KONG

As addressed by the cage/coffin homes case studies, Hong Kong's housing issues are making it difficult for its inhabitants to stay within the city centres, yet they have no choice since there are no viable alternatives to their living conditions. The *OPod Tube House* is currently developing a solution proposed by the James Law Cybertecture studio. James Law, the studio's founder, explains that the project offers to ease Hong Kong's housing issue through the development of "low-cost, stackable micro homes in concrete pipes, which could clot into gaps between buildings" (Block, 2018). According to Law, he foresees these structures mounted on top of each other, providing affordable starter dwellings for young people in city centres. Law also states that his proposal is not a temporary solution for the region's housing issue, but trusts that it would offer temporary relief for the urban inhabitants in search of affordable, short-term tenancies ("OPod Housing No.1," n.d.).

Figure 50. OPod Tube Houses.





The *OPod Tube House* is divided into two sections: a living area and a bathroom. The individual tubes are made of 2.5m diameter concrete water pipes, with a double-glazed steel-frame window and entrance door leading either to the dwelling's living area or the bathroom depending on the house's orientation. The living area contains a sofa bed, a working desk, some shelving units, a clothes hanger rack and stow desk for luggage, a ventilation unit, and a small kitchenette consisting of a sink, a bar refrigerator and a microwave. Its interior wall is the water pipe's inner diameter lining and its flooring is made of wood with a polished wax finish. Fluorescent lights on two long trays serve as artificial lighting for the area while natural lighting comes from the glass window and door. The bathroom is smaller in comparison to the living area and is separated by a concrete wall with a glass sliding door. The toilet and basin take up a small side of the bathroom while the remaining space serves as the shower. Its flooring is also made of wood but has a dark stain finish with thin slits separating each plank to allow water through since it serves as a shower tray as well, and the interior lining is made of small ceramic tiles. Two fluorescent lights above the basin and the shower head operate as the bathroom's artificial lighting. The dwelling emanates a dull and monotonous atmosphere due to the material finishes and the yellow-tinted artificial lighting. Rather than providing a comforting space for the urban inhabitants amongst the restrictive spaces they once lived in, the house only seems to offer brief comfort mixed with a wow factor brought about by the house's unconventional design.

This case study tackles minimal space programming, essentially *existenzminimum* and its application as a solution for the inherent issues of metropolises. However, rather than offer a solution to the issues, the dwelling only intends to patch-up the issue by providing temporary shelter instead of long-term dwellings for inhabitants. The design already shows potential to adapt into proper dwellings through several improvements to promote comfort:

- Adding an extra concrete pipe for storage space.
- Adding a nicer material finish for the interior fittings and the interior concrete wall lining.
- Providing user customisation for the space.

Figure 51. OPod Tube's interior.





These suggestions do, however, bring into light the setbacks temporary minimal dwellings are only capable of providing. In order to develop a successful alternate future minimal urban dwelling, the importance of providing the maximum amount of comfort within a minimal space is prevalent. Having a restrictive interior form limits the inhabitant's productivity and comfort, which in turn affects their wellbeing. Granting inhabitants liberty of customisation offers them a space they can label as theirs. Additional storage space is always positive for any form of dwelling, especially in urban areas where the restriction of available space makes it difficult for inhabitants to own large and more belongings. Having dedicated spaces for programmes provides less space for the residents to do activities.

Overall, this case study is not quite the bare minimum the thesis should output since there are still elements in the project that need improvement to match the thesis's aims and objectives. While some consider temporary dwellings as a potential alternative for future urban dwellings, this thinking is not condoned by this thesis. It provided insightful feedback that helps cement the groundwork for the proposed alternative to future urban dwellings.

Figure 52. Proposed OPod housing scheme.



## 4.4 SUMMARY

Minimal dwelling is both an issue and a concept that has had countless undertakings, some successful while others are not. The case studies raise similar issues inherent to past, present and future metropolises; however each project offered different approaches to alleviate these issues. The underlying implication extracted from these projects is that user experience, including comfort and individuality, functionality and storage contribute to generate a successful minimal urban dwelling. A minimal space is defined by a person's gauge of the concept minimum, allowing for a varying interpretation of the minimal dwelling.

Through the guidance of these case studies, the thesis should develop a minimal dwelling that:

- Utilises the maximum amount of the minimum interior space provided – a maxi-minimal interior space,
- Offers interchangeable functions contained not within the maxi-minimal space but along it,
- Contains more than enough storage to cater for most inhabitants,
- And provides space customisation for the inhabitant to support comfort and individuality.







## CHAPTER FIVE

DESIGN  
EXPERIMENTATIONS



This chapter is comprised of of design experiments influenced by the literature reviews and case study analyses. It aims to give details about the initial development process leading to the proposed alternate future urban dwelling's design.

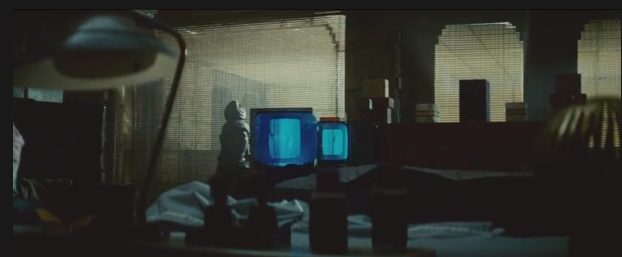
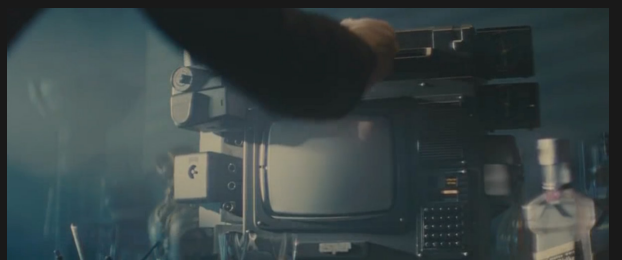
This chapter is organised to provide a detailed understanding of the design approach for the proposed design from the influences provided by the literature reviews and case studies pertaining to the thesis.



## 5.1 FILM ANALYSES

One of the literature reviews conducted for the thesis was the analysis of several science fiction films portraying visionary architecture of the future. Part of the analyses of the films is an experimentation involving the recreation of the interior living spaces solely through the shots offered by the film and defining their framework based on the elements contained within each shot, all performed during one viewing. The films were viewed once more, this time comparing the findings from the first viewing and resolving any discrepancies. This ensures thorough and factual film analyses.





## Blade Runner (1982), Directed by Ridley Scott

One of the films selected for the experiment is Ridley Scott's *Blade Runner* (1982), a cult-classic cyberpunk film known for its dishevelled, murky and industrialised depiction of future urbanism. Scott's vision of future urban living reflected on his portrayal of Deckard's apartment (Scott, 1982). Deckard, the protagonist, lives in a studio apartment based on Frank Lloyd Wright's Ennis House (Sveiven, 2010) and situated in a skyscraper condominium building. The ornamental and economical concrete blocks combined with the manipulation of lighting and varying camera perspectives under Scott's direction create an almost overbearing yet familiar atmosphere inside the apartment. The cluttered arrangement of the furniture further assists this, thus re-iterating the common trope of a single man's apartment. While recreating the apartment interior, there were inconsistencies regarding the overall scale of the apartment, mostly due to the confusion caused by shot angles for the interior, as there are breaks in between some shots to emphasise the characters and the plot. After the second viewing, it became clear that Deckard's apartment is not a prime example of what an alternative urban dwelling should be. Scott's portrayal of it in the film is the current urban life, and the only futuristic concept throughout the entire film was everything, including the somewhat hi-tech computer only present in one scene, except for the apartment interior space.

Figure 53. A collection of scenes from *Blade Runner* by Ridley Scott. 1982.

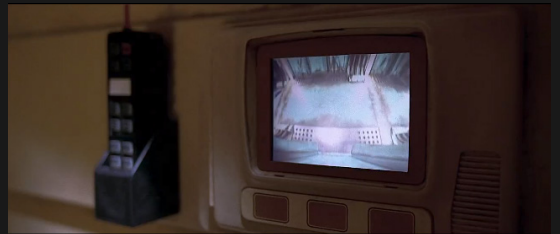
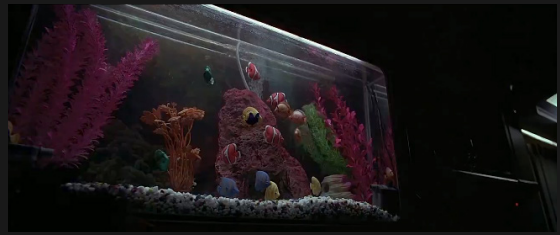
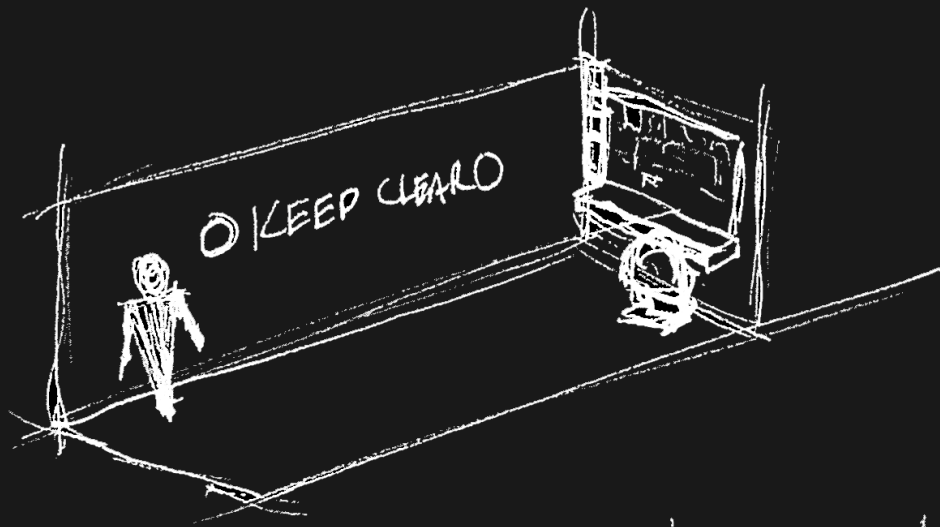


Figure 54. A collection of scenes from *The Fifth Element* by Luc Besson. 1997.

## **The Fifth Element (1997), Directed by Luc Besson**

Another film selected is Luc Besson's *The Fifth Element*, a futuristic sci-fi film considered as a cult classic and often criticised as both the best and worst summer blockbuster of all time. The film has a rich and vibrant universe setting-wise, especially Besson's portrayal of future urbanism (Besson, 1997). The city resembled New York, but with even taller buildings and littered with traffic. Pollution, overpopulation, consumerism and other urban living issues were present throughout the entire film, hindered by the lacklustre and generic plot that a typical 1990s action film had. It can be considered as the most basic depiction of future urbanism, yet its visual execution of every detail was fantastic. Besson's vision of future urban living highly reflected on Dallas Korben's apartment.





### Korbia's Apartment

- approx.  $3m \times 3m$  <sup>floor area</sup> <sub>in area</sub>,
- total floor area is approx.  $4m \times 5m$  ( $4 \times 6$  <sup>max</sup> ~~at mo~~)
- 3m width (max) 2.8m (min)
- 7m depth (max) 6m (min)
- 2.5m height (max) 2.4m (min)



Korben, the film's protagonist, lived in an open studio apartment located in one of the skyscrapers apartments. The apartments within the building all have the same basic design, yet each of them had unique personalities that reflected the tenant's own personality. One of the internal walls in Korben's apartment contained all of the necessary facilities and services required in a single bedroom apartment – a single bed that slides into the wall, a fixed shelving unit and wardrobe above the sliding bed, a shower room interchangeable with the refrigerator, and a fixed kitchenette with more shelving units. The opposing wall to the 'programme wall' has a Keep Clear sign used as crowd control for security and law enforces' use. On the side of the slide-up entry door is a small monitor serving as both an intercom and a television. Opposite the door is a large operable window, along with a bar and stool propped against the wall and a mail chute by its side. The apartment ceiling also has a cascading storage compartment that Korben uses to store his firearms. Korben's apartment is a successful example for an alternate urban dwelling since it addresses a majority of the issues prioritised by the thesis and provides insightful concepts that will help the thesis develop, such as interchangeable facilities and services, and maximising minimal space.

Figure 55. A drawing of Korben's apartment based on a series of shots from the film.

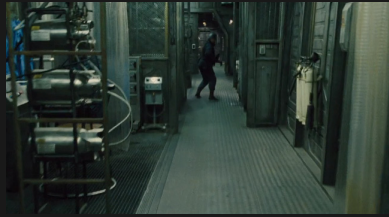
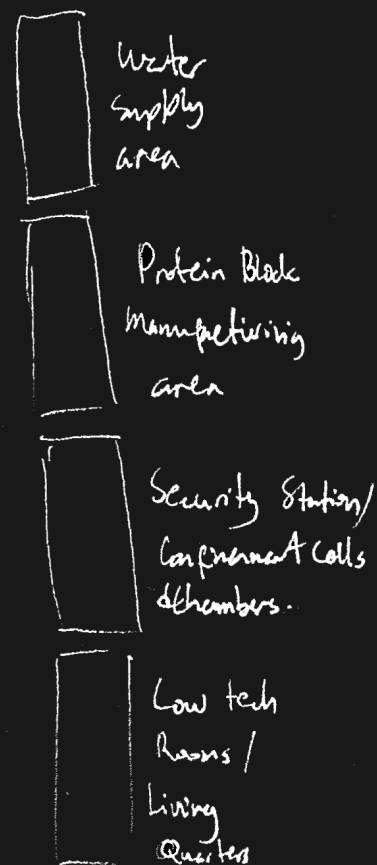
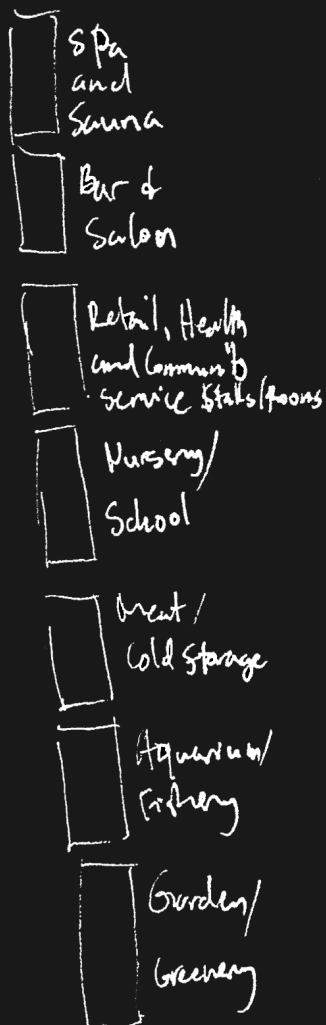
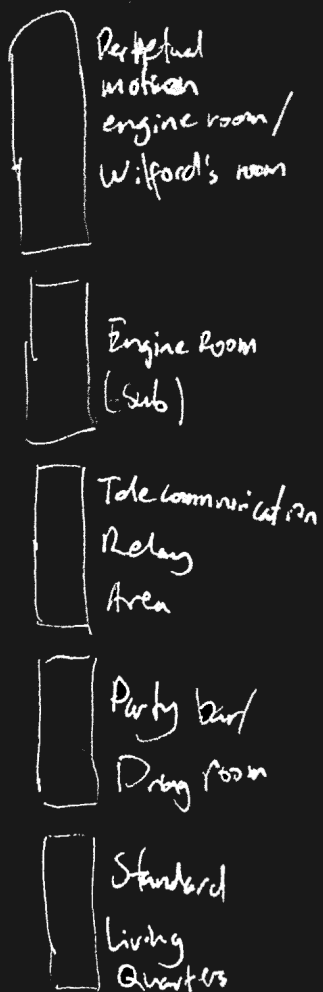


Figure 56. A collection of scenes from *Snowpiercer* by Joon-ho Bong, 2013.

### **Snowpiercer (2013), Directed by Joon-ho Bong**

Joon-ho Bong's *Snowpiercer* is a dystopian sci-fi film about the last of humanity's survival inside a perpetual moving train (Bong, 2013). Having the entire plot of the film develop within a long, diverse interior world is something Bong captured with great success. The entire train's layout is a hierarchal system, segregated into class statuses with the low class situated at the rear while higher class occupied the carts from middle to front. Each train car has different programmes based on the train's cart layout, with laboured and derelict programmes at the rear leading to more lavish and indulgent programmes near the train's engine.

Head

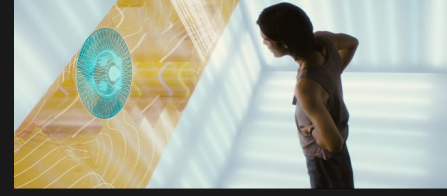
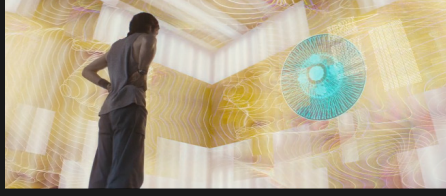
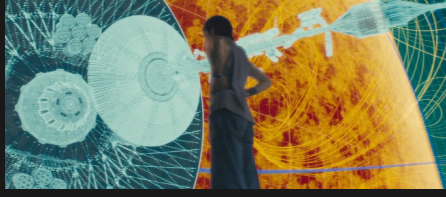
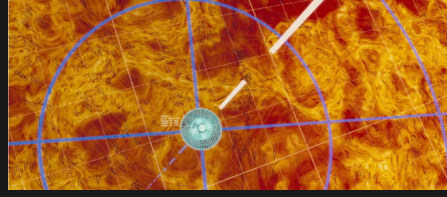
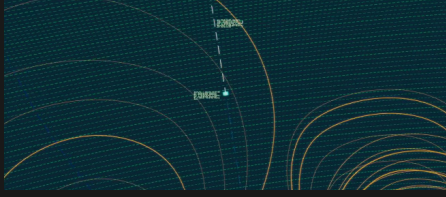
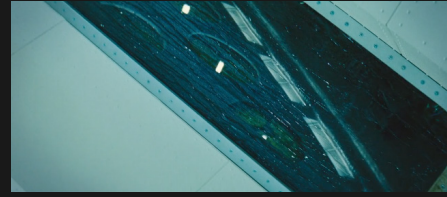
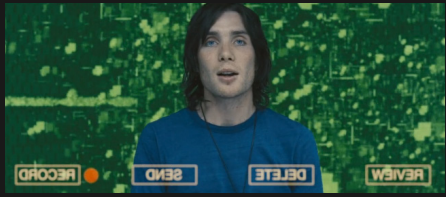


Tail

Bong's image of a post-apocalyptic settlement is interesting since it converts a mode of transport into a small, moving urban settlement, comparable to a nomadic convoy of trailer homes. The concept is fascinating since each train car has a uniform dimension yet each felt tailor-made for the programme, which varied in size. A fully efficient design tailoring to the dweller's needs leads to a fully compact and user-efficient living space, a prerequisite for alternate future urban dwellings.

Figure 57. A drawing of the train's programme layout based on a series of shots from the film.

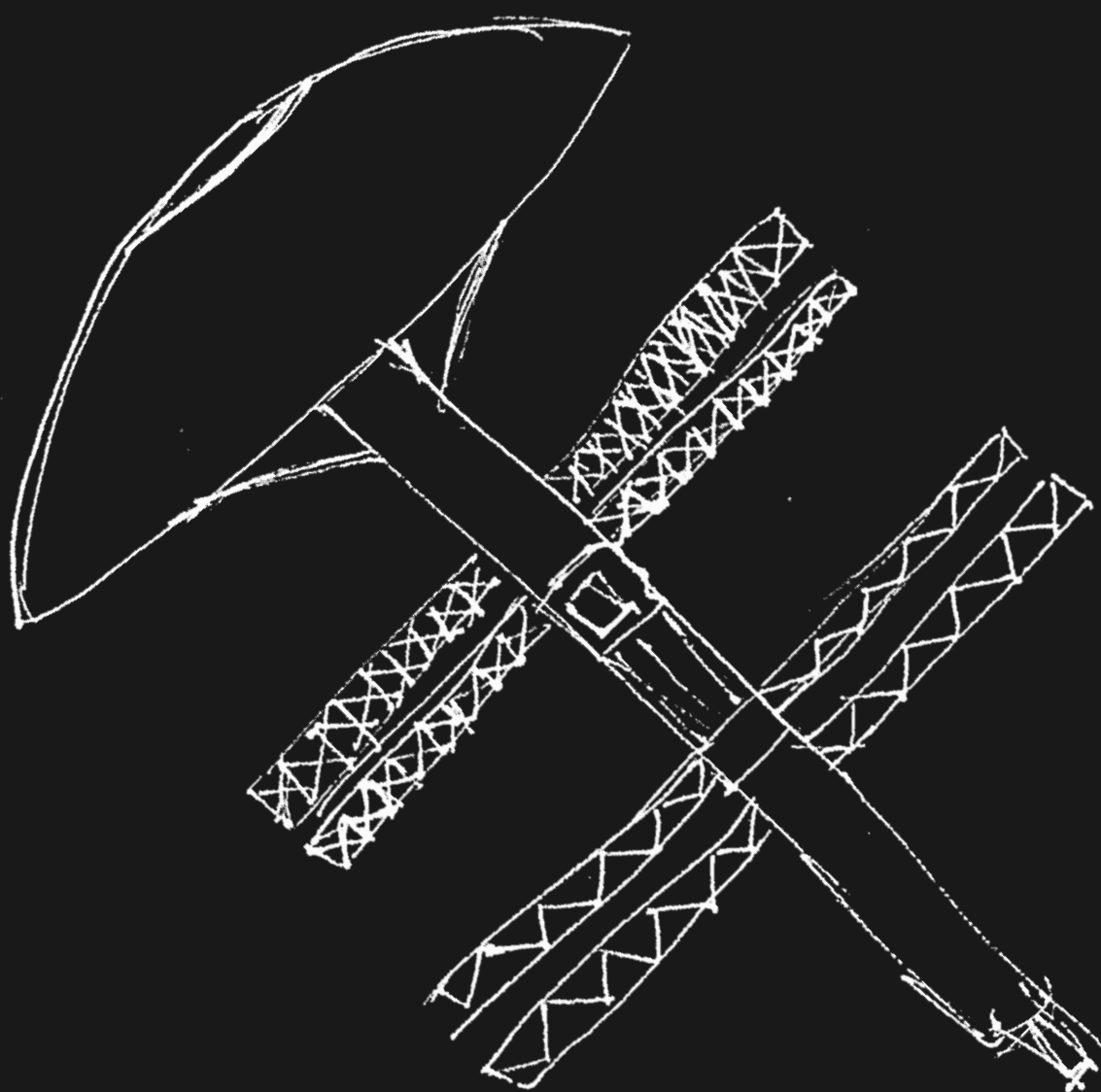




## **Sunshine (2007), Directed by Danny Boyle**

Danny Boyle's *Sunshine* is another dystopian sci-fi film about a space crew's attempt to jump-start the dying sun (Boyle, 2007). The majority of the film happens within the spaceship inbound for the sun. The ship's interior shares a resemblance with the current International Space Station's interior with minor modifications such as a sun-viewing room and an oxygen farm filled with produce plants. The ship also contains a 360° viewing cube used by the crew for mental stability support and as a multi-purpose display room. The kitchen is a standard communal kitchen with a dining table in the middle.

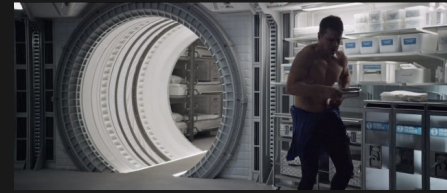
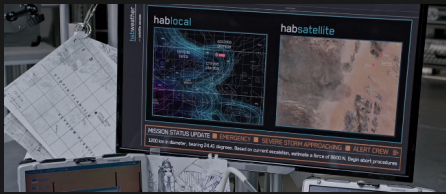
Figure 58. A collection of scenes from *Sunshine* by Danny Boyle. 2007.



Out of the seven films analysed, this film has the least amount of impact to the progress of the thesis. Aside from the interesting technology and the oxygen-producing farm present within the spaceship, there are no new concepts that the thesis can benefit from in this film.

Figure 59. A drawing of the space stations exterior based on a series of shots from the film.







## **The Martian (2015), Directed by Ridley Scott**

Figure 60. A collection of scenes from *The Martian* by Ridley Scott. 2015.

*The Martian* is another sci-fi film directed by Ridley Scott. It is about the survival story of an astronaut trapped on Mars after an unprecedented dust storm forced their team to evacuate the planet. Mark Watney, the trapped astronaut, transformed their team's still functional base into a survival shelter, including an impromptu potato farm using Martian soil and human excrement as fertiliser (Scott, 2015).

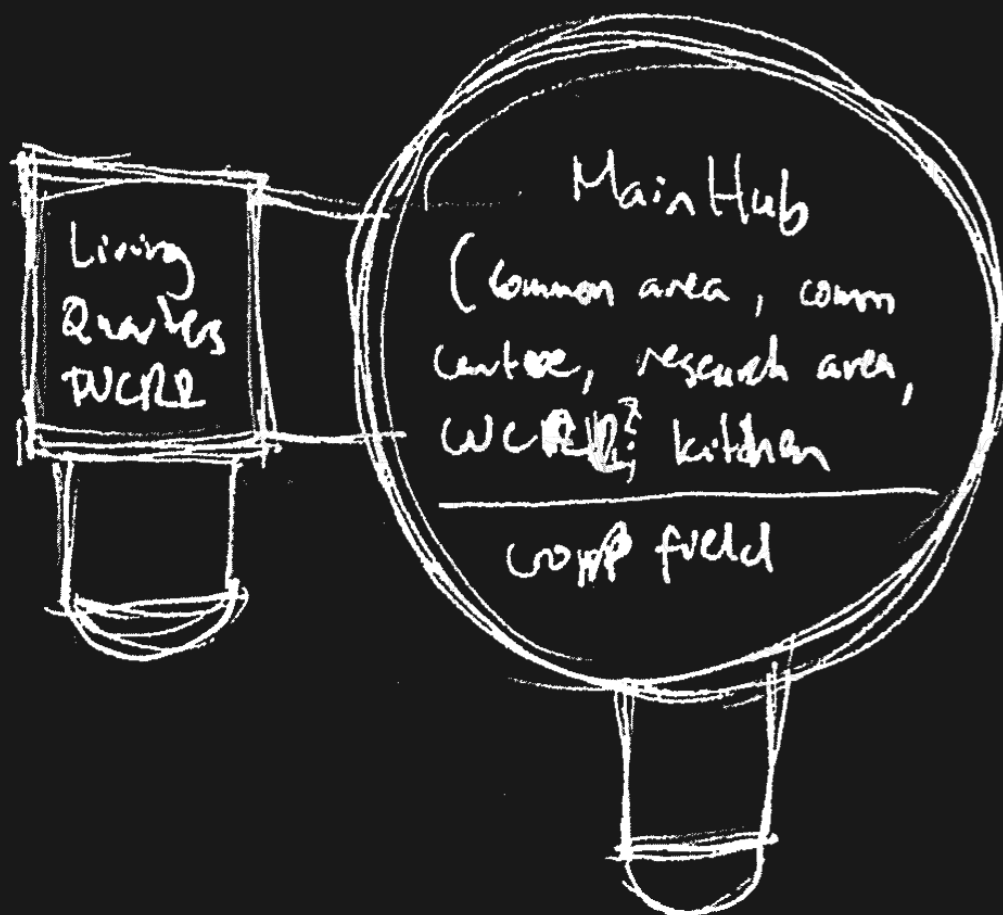
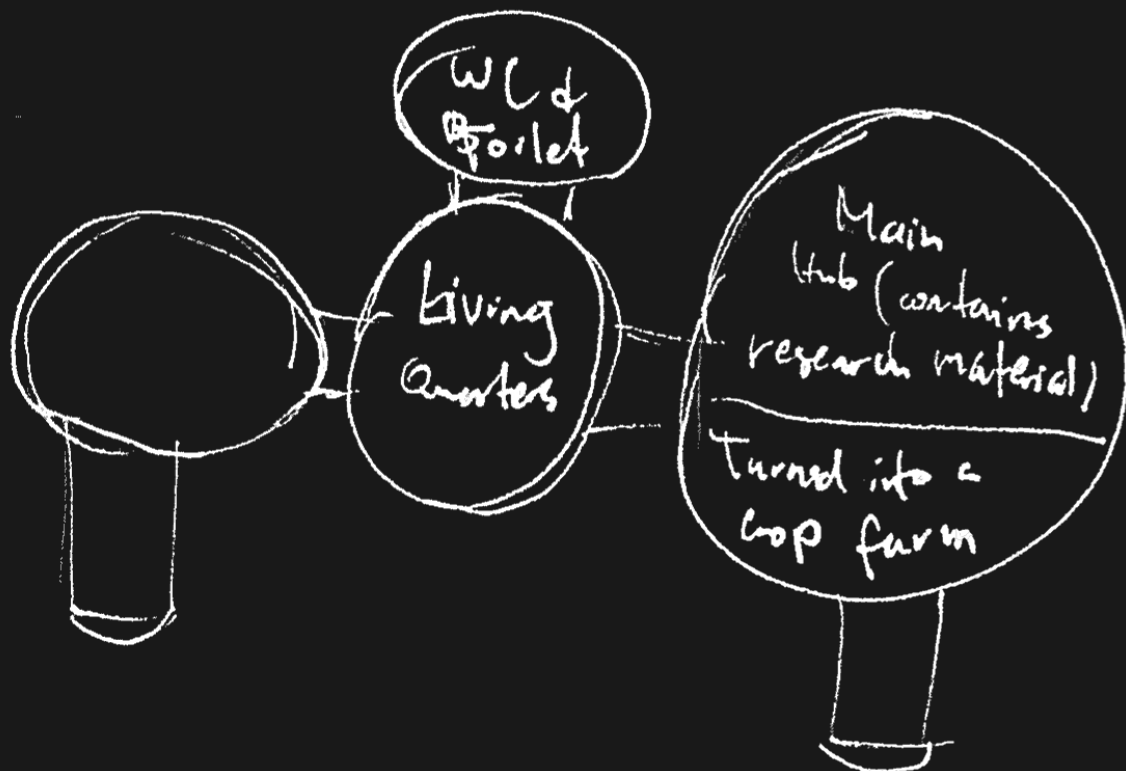
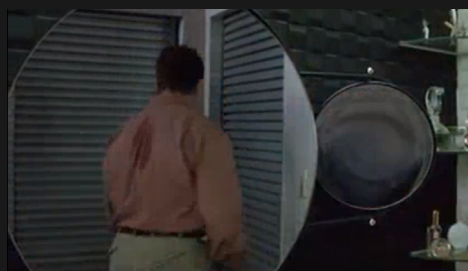


Figure 61. Drawings of the Mars base during the first (top) and second (bottom) viewings based on a series of shots from the film.

During the experiment, the base's design is drawn through the interior perspective. Using the external perspective of the base as the guide for the second viewing, the base's design is compared with the first drawing. Both drawings had similar programmes, yet the layout of the whole base was completely different in each drawing. The interior perspective portioned out the different programmes and alluded to separate rooms, while the exterior perspective revealed a more open and smaller form than the prior. Scott's portrayal of extra-terrestrial living is akin to future urban living in terms of necessities. Disregarding the fact that the leftover equipment served as the film's silver bullet, the concept of using the existing technology and knowledge to repurpose a space's intended programme is beneficial to the thesis since it has the potential to absolve any lingering living issue. If a living space contains multiple programmes that correlate and do not hinder each other, there would be less excess and unused space for the dweller to worry about.

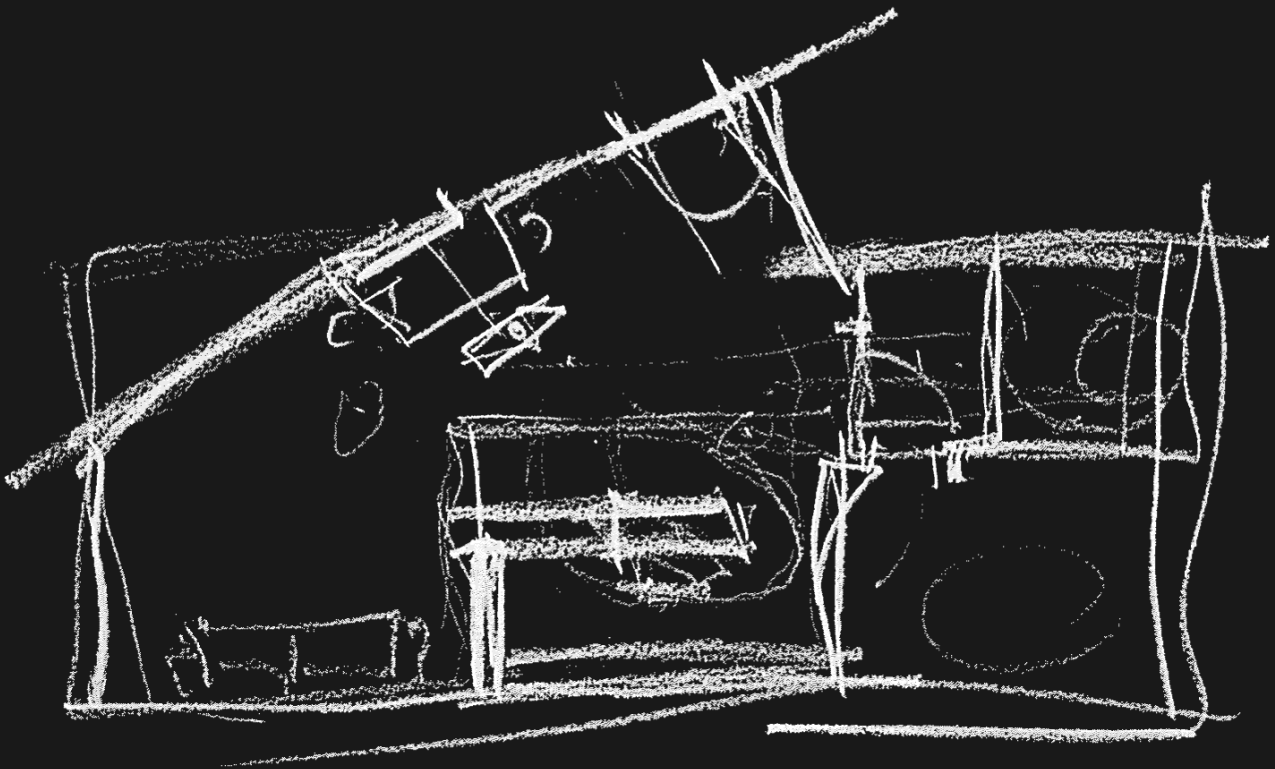
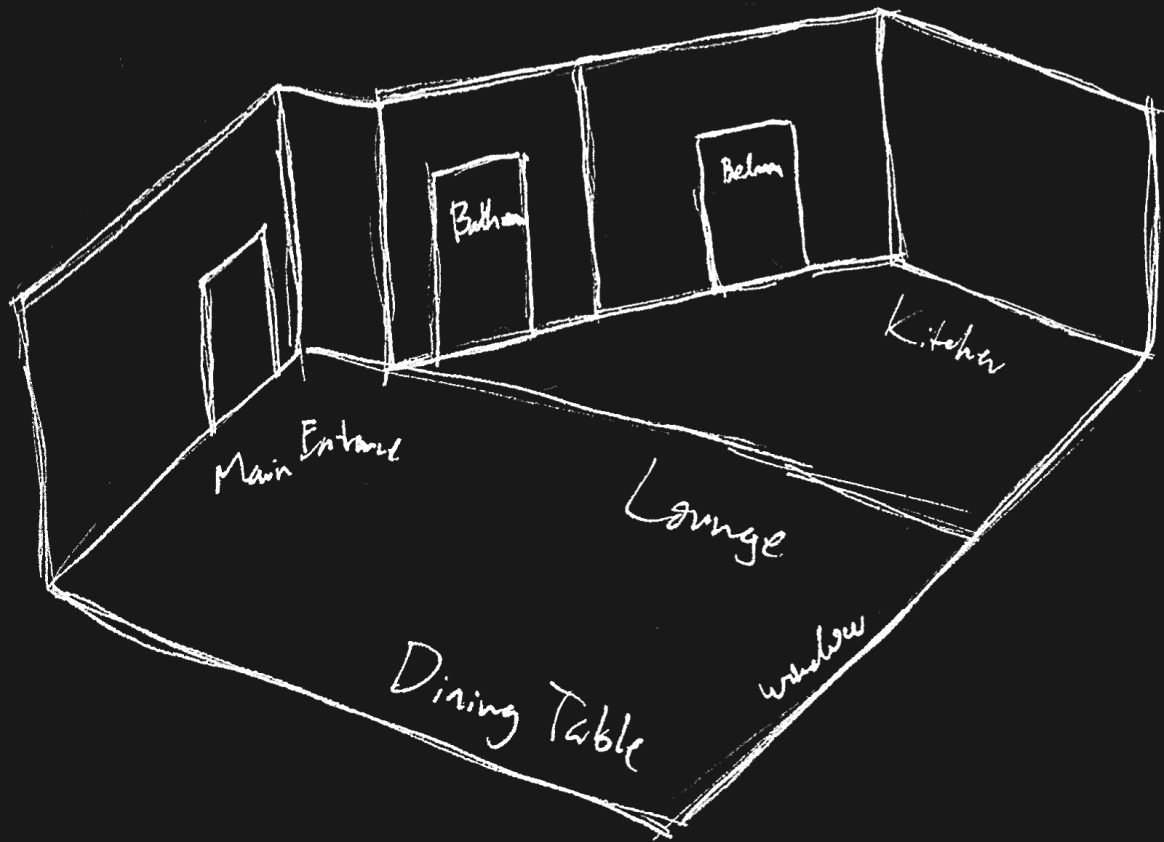


## **Total Recall (1990), Directed by Paul Verhoeven**

Paul Verhoeven's *Total Recall* (1990) is a dystopian sci-fi film about a construction worker finding himself entrapped in espionage on Mars, uncertain of the experience's authenticity due to memory implants (Verhoeven, 1990). Verhoeven's portrayal of future urban living is shown through Douglas Quaid's apartment. Quaid, the film's protagonist, lives in a one-bedroom apartment with an open kitchen, a lounge and a bathroom. The apartment has a conventional design commonly found in apartment buildings; however, the one thing that stands out about it is the application of technology within the apartment. The wall aligned with the dining table is also a large monitor screen capable of displaying images and television shows, as well as a holograph display located on the ceiling lights for activities such as exercising.

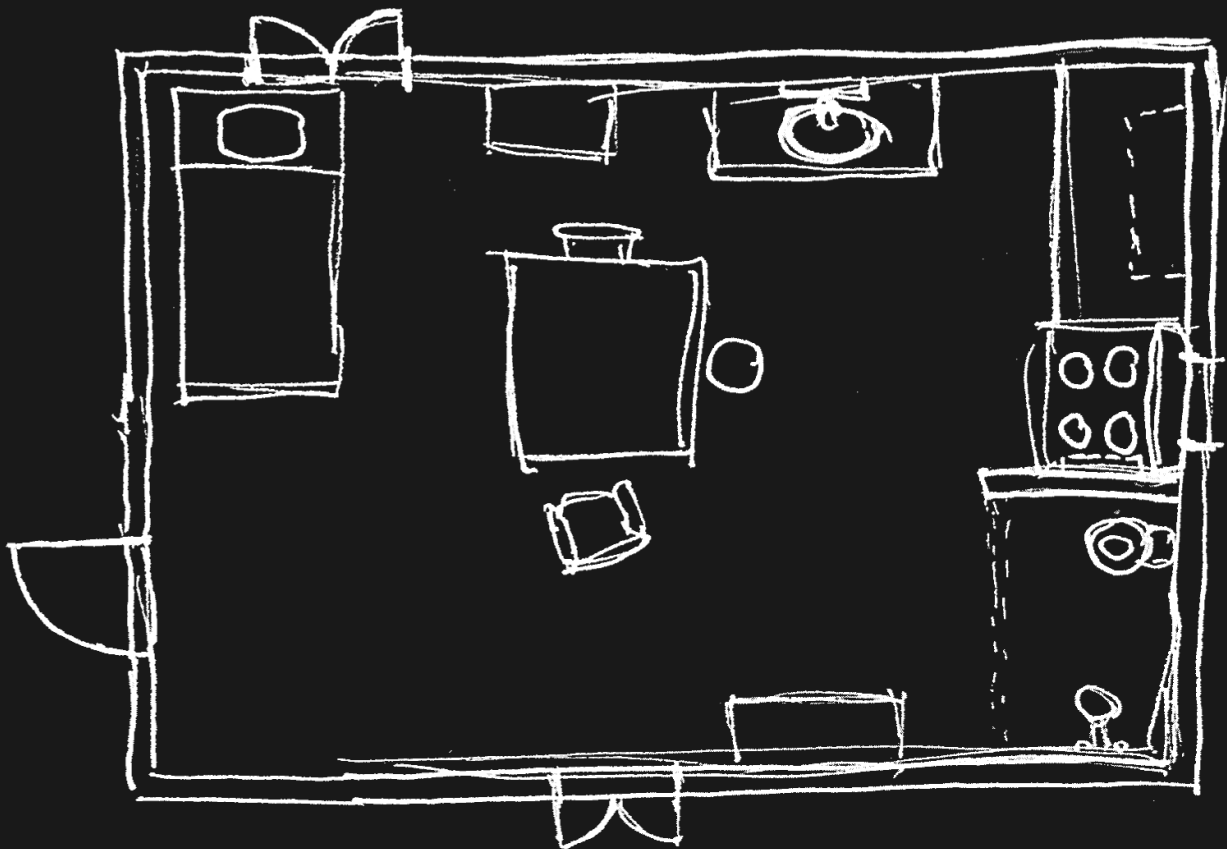
Figure 62. A collection of scenes from *Total Recall* by Paul Verhoeven. 1990.





Recreating Quaid's apartment for the experiment encountered the same issues as the *Blade Runner* analysis; however, this was easily resolved after multiple viewings of the film. During the first viewing, the bathroom is located within the bedroom while the lounge has the same area as the kitchen and dining area combined. Verhoeven's delivery of a very simplistic approach to future urban living reflected by the apartment's interior does not offer any necessary input for the development of the thesis. However, it does establish the standard for what an alternate future urban dwelling must not become.

Figure 63. Drawings of the Quaid's apartment during the first (top) and second (bottom) viewings based on a series of shots from the film.

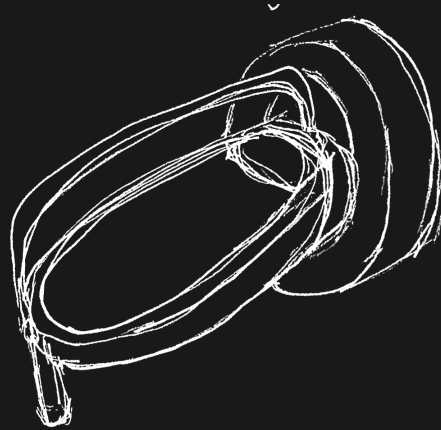


## **Elysium (2013), Directed by Neil Blomkamp**

Lastly, Neill Blomkamp *Elysium* is the final film selected for analysis. It is a dystopian biopunk film about a factory worker's attempt to cure his Stage 4 cancer, acquired from exposure to a high dose of radiation, by travelling to a pristine man-made space station where the technology to cure any illnesses exists but is only accessible to the very wealthy (Blomkamp, 2013). The film offers two types of interior living spaces, the wealthy dwellings and the low-class dwellings. Max Da Costa, the film's protagonist, lived in a grubby single floor house located in a slum, with no internal walls separating the facilities and services. The interior looks shabby and unkempt, but is still structurally safe. The house contained worn-down furniture, small windows on three walls with a framed single bed aligned along one, a bathroom and shower beside the kitchen, and lounge area also serving as the dining area cluttered with clothes and rubbish. The space reflected a typical depiction of a living space occupied by a single person. Containing only the necessary facilities and services, the interior space is minimal and efficient.

Figure 64. A collection of scenes from *Elysium* by Neil Blomkamp. 2013.

Figure 65. A drawing of Da Costa's dwelling based on a series of shots from the film.





In contrast to the low-class dwellings, the wealthy dwellings had large, grandiose and minimalistic design schemes. All of these dwellings are located in the man-made space station, far away from the soiled and shambolic living situation down on Earth. The most important aspect of the wealthy dwelling is the all-healing machine accessible within all of the dwellings. The space station houses the machines and the system controlling them, and it is the only location in the entire film that contains the technology. Blomkamp's vision of future living is easily applicable to urban areas since it involves issues that apply to all of dwellings.

Figure 66. A collection of scenes from Elysium by Neil Blomkamp. 2013.

Figure 67. A drawing of the healing pod within the space station dwellings based on a series of shots from the film.



## Self-Critique and Interim Reviews

By the end of each analysis, there are certain recurring concepts present in each of the analyses;

- the presence of technology within each interior space,
- the diverse interpretations of a future interior living space,
- and the quality of life experienced by the inhabitants within each interior space.

Each interior either relied upon or contained traces of high technology within, hinting at the need for using technology to develop future urban dwellings. Technology must be present within the proposed design of an alternate future urban dwelling, even within the wet areas of the dwelling. Having diverse interpretations for future interior living spaces signifies the conditional priorities set by the directors. The size of an interior space in film must be able to fit an entire camera set, thus requiring most space to be larger than the intended inhabitant limit. This reasoning helps solidify the need to limit capacity to house people in the proposed design to a maximum of two per dwelling, since any space large enough to house more than two people cannot be considered minimal anymore. The quality of life for the inhabitants in each film is pretty similar to each other, especially for the protagonists – they are living in poor to average conditions, with some form of access to the necessary functions and live in a minimal dwelling. Although each interior has access to these necessary functions, their quality is far from good and the method of access is convoluted. This analysis established the need for a good quality living condition and easily accessible functions for the proposed design.

During the first interim design review for the thesis, a critic questioned the reason for the choice of films to define future living. *“Why where these films selected for review rather than films depicting a future of alternate universe such as Gary Ross’s Hunger Games, Neill Blomkamp’s District 9, or even the Wachowski brothers’ The Matrix?”* The deciding factor to why these nine films were selected is due to how close these films portray their urban life to the current urban living. Since this thesis aims to produce an alternative to urban minimal dwelling due to future urban issues, which are based on current and prevailing urban issues, then these nine films are excellent pieces for the development of the thesis.



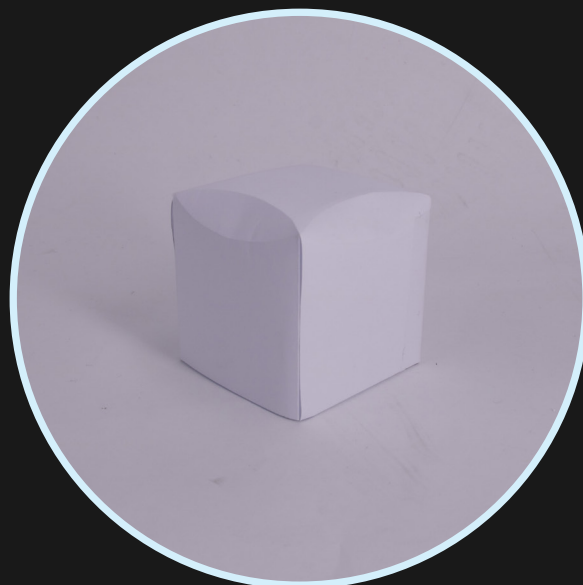
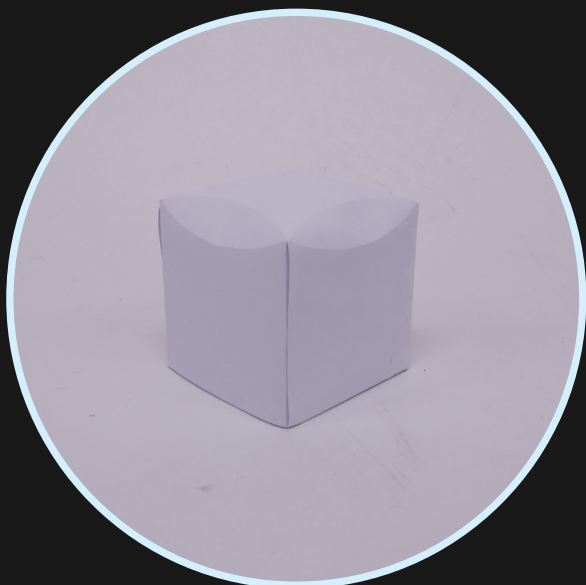
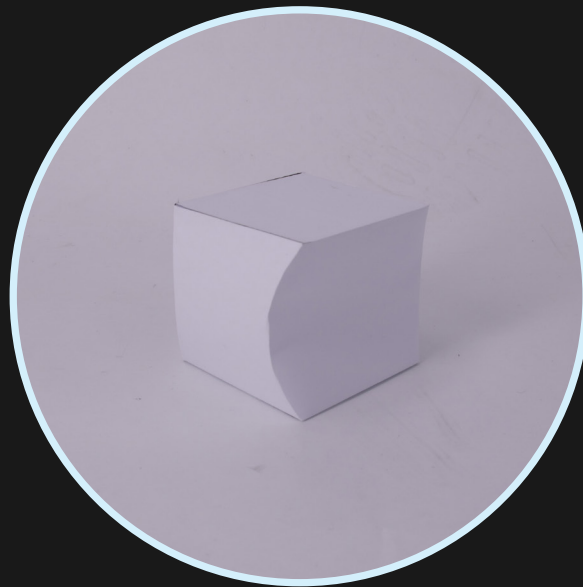
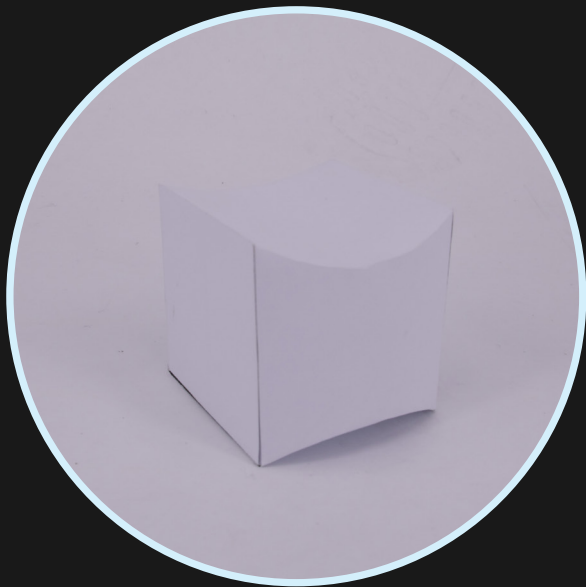
## 5.2 MODULAR MODEL EXPERIMENTATION

The recurring methods that the Metabolist Movement and *Archigram* reiterate on their projects are prefabrication and modular design. Prefabrication is an assembly process where the structure and parts are assembled in a factory and transferred onto the site once they are either partially or fully assembled. Modular design is a design approach where a design's elements are subdivided into small parts that can be formed independently and utilised in other designs, and they are assembled on site (Craven, 2017). These methods are often coinciding and effective for low-cost, large scale projects, proving to be a viable approach to develop a design for an alternate future urban dwelling.

The modular model experiment conducts test design approaches to achieve an ideal interior and exterior form for the proposed alternate future urban dwelling through the influence of prefabrication and modular design. The experiment consists of two segments:

- Producing a stand-alone form with modular capabilities. This will gauge the viability of a standard modular form as a base for the proposed design.
- Producing a modular form using modular components. This will gauge the viability of a modular form comprised of small modular composed to create a uniform modular form as a base for the proposed design.



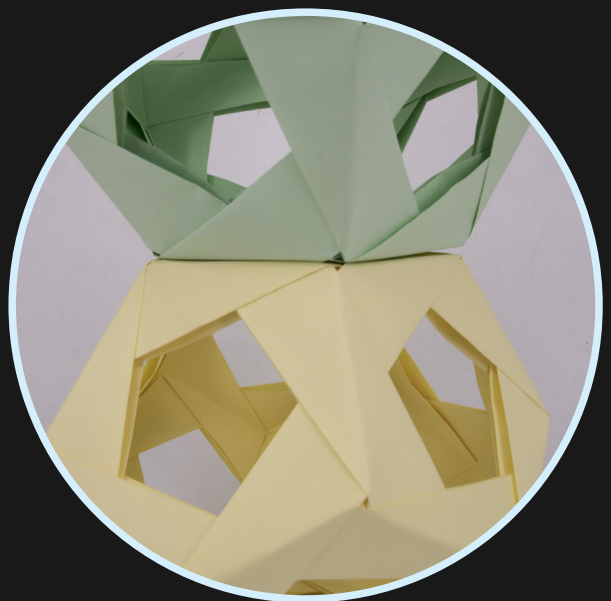
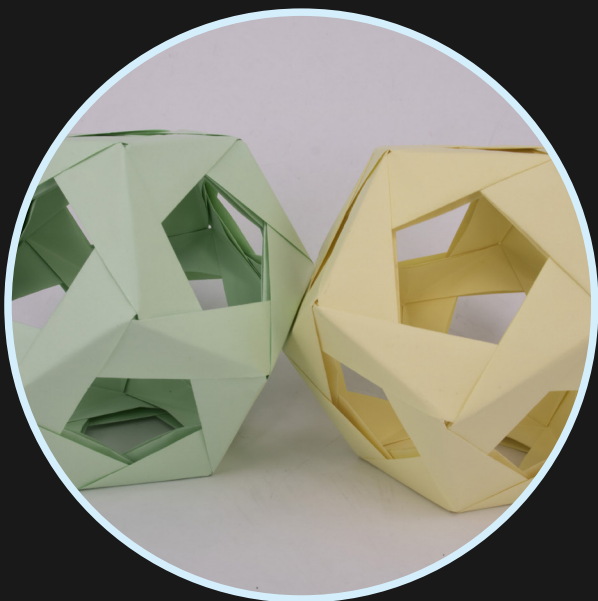
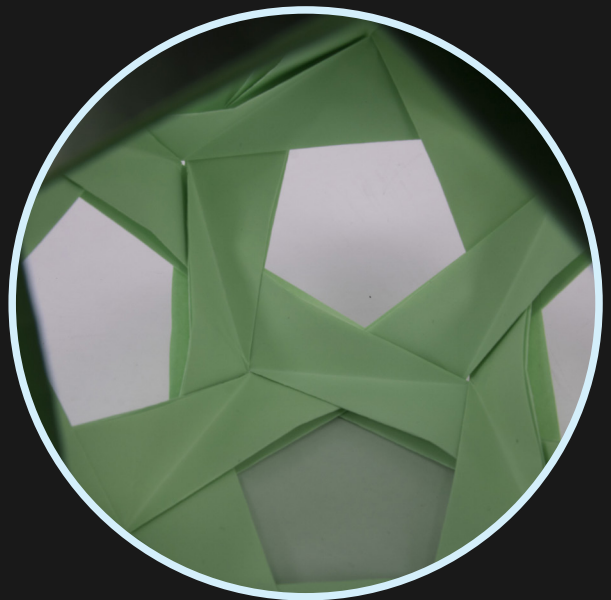
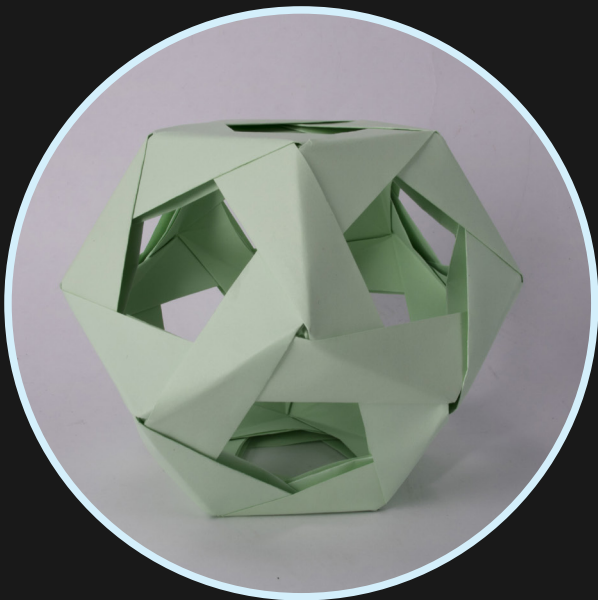


## Stand-alone Modules

For the first segment, two different paper models were crafted based on the same type of modular form. The two models have several curved surfaces to check the potential of attaching units with curved faces. Using curved faces on surfaces such as walls provides an inhabitant with the perception of a large space depending on the arches.

- The first model has four curved faces, each perpendicular to the other curved faces, allowing for interconnections along a planar axis.
- The second model has four curved edges connecting on the same face, allowing for a more concave ceiling.

Figure 68. Two physical experiment models, one with curved faces (top images) and another with curved edges (bottom images).



## Modular Modules

For the second segment, two different set of models, one set containing two identical models, are crafted based on the same type of modular configuration. The two models are comprised of smaller identical modular components connected to create a modular form. Using smaller components to create a form determines the maximum capable size of a modular form.

- The third model is a collection of nine identical cubes joined together along the edges, allowing the model to expand and shrink its size on command.
- The fourth and fifth models are each comprised of thirty identical units joined together to create vertices of a dodecahedron, allowing for a uniform connection along each face.

Figure 69. Three physical experiment models, one with nine small, identical cubes (top images) and two identical dodecahedrons (middle and bottom images).





## Self-Critique and Interim Reviews

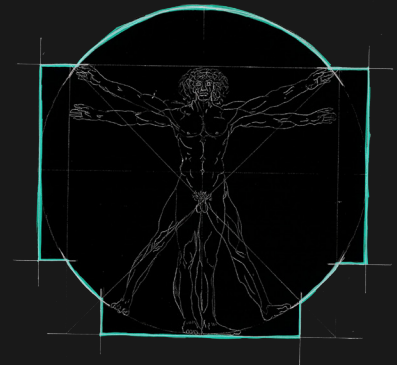
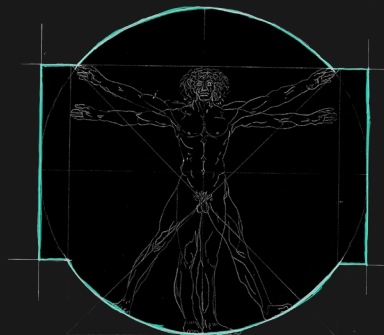
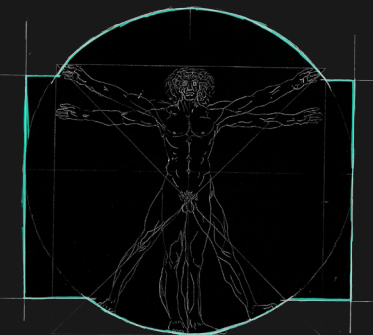
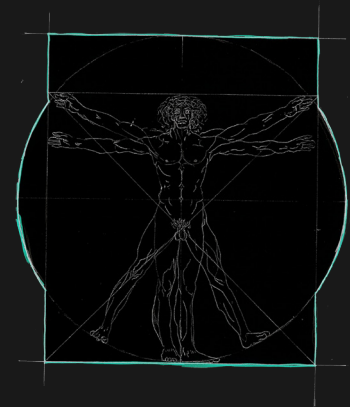
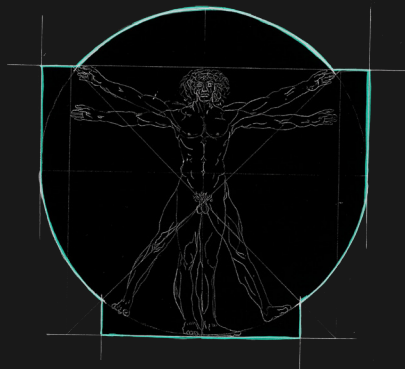
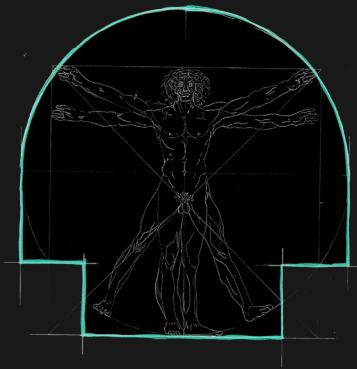
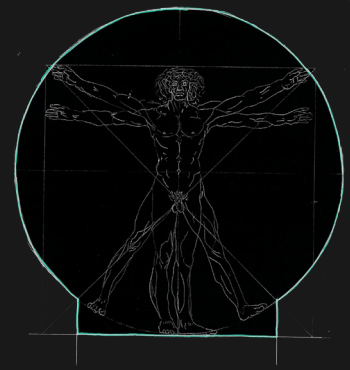
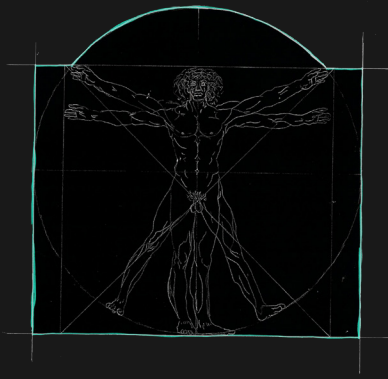
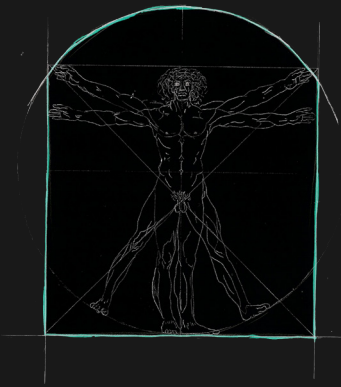
After crafting and assessing each one, all of the models generated both positive and negative results. The first model provides a cohesive connection method to similar modules, showing potential as a template for the proposed design. It does have a downside, though, due to the curved surface it has – these curved faces do not yield more space since the model's volume is the same as a cube with the same dimensions as the model. The first model offers no extra space, even when connected to other modules, making it unviable for the proposed design's interior space. The second model is the least successful out of all the models for the experiment. It resembled a generic cube form too much, making it somewhat unappealing compared to the rest. Another negative factor is the curved vertices—it made connecting with other modules on that particular face difficult and miss out on the potential to connect to more modules. However, one positive aspect about the second model is the idea of having a non-linear ceiling to reduce waste space inside an interior, a potential benefit for the proposed design. The third model is somewhat generic since the base module used was cubic in form; however, it does propose the idea of expansion as a method to mitigate spatial balance within a minimal space. The fourth and fifth models show potential as the proposed design's exterior form due to the non-planar method of connecting to similar modules; however, it does not translate well when applied into the interior space since changes in planar axes make it difficult to use upright faces as levelled floors. In order to have levelled floors inside the models, it is necessary to create a new levelled surface to serve as the floor, resulting in unused space underneath the new floor and unviable as a minimal dwelling space. The fourth and fifth models are larger in scale compared to the other models, thus making it easier to imagine the space relative to human scale. Using their scale as a guide, the models indicate the maximum and minimum limits for the proposed design's interior size – the maximum size would be when the two models are connected and the minimum would be the initial size of one of the models.

Although there were no direct critiques from the interim design reviews regarding the experiment, the method of interaction between the inhabitant and the space was a concern. In order for the proposed design to house both the inhabitant and the necessary functions, there needs to be sufficient space for the functions without affecting the main space for the inhabitant. The inhabitant's space must remain unhindered by function; therefore, the space of each function must either exist outside the overall space or surround the inhabitant's space.



## 5.3 VITRUVIAN MINIMAL SPACE

Producing an urban minimal dwelling was the outcome the case studies aimed to achieved, justified by the minimal structure, form, atmosphere, and functions existing within them. The case studies provided showed hints of elements of minimal living; however, most of them have not fully exploited the entire concept of *existenzminimum*. This experiment enforces the spatial aspect *existenzminimum* and determines the most comfortable and efficient interior space possible based on a human's maximum limb span, using Leonardo da Vinci's *Vitruvian Man* as the template to measure out the spatial limit for the proposed design.

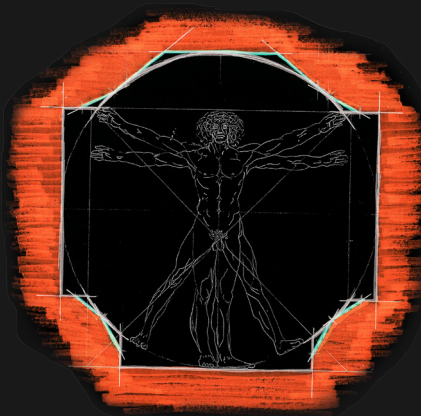
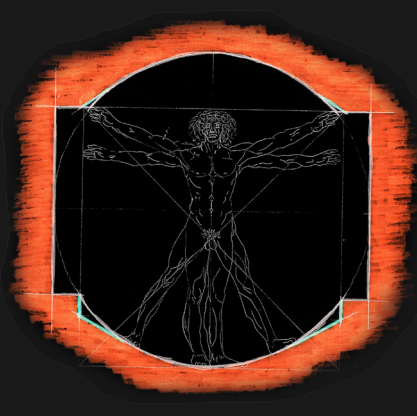
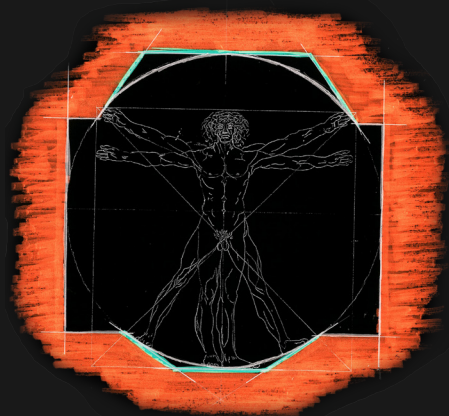
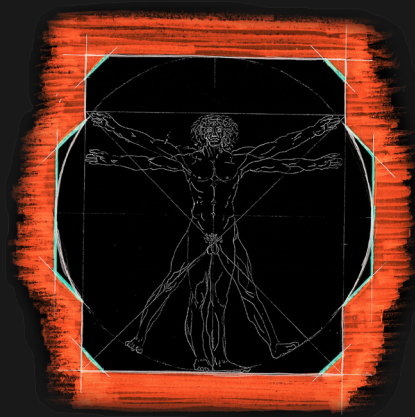
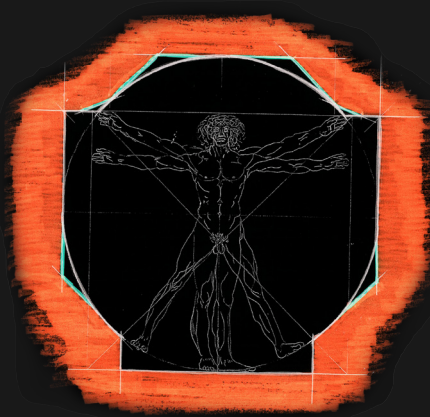
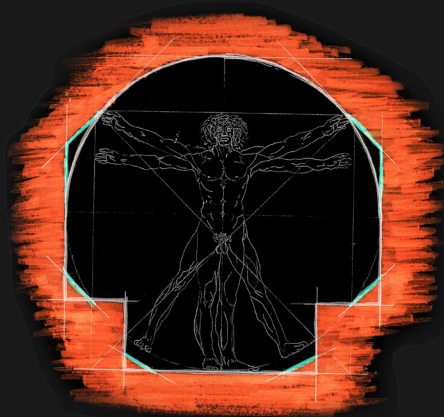
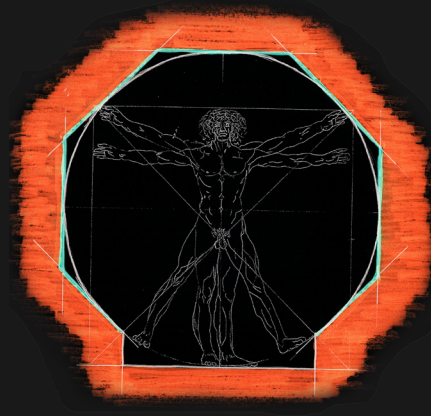
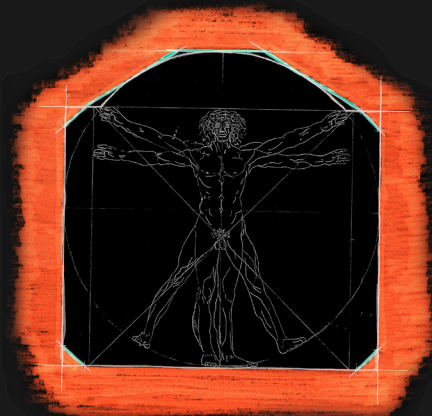
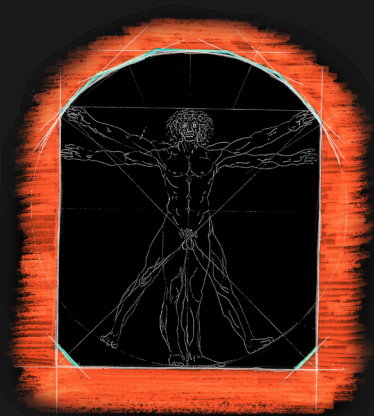


## Base Drawings

A total of nine iterative drawings are produced as the base for the experiments. Each drawing uses the *Vitruvian Man* as the base and has a different form based on the maximum span. From these drawings, four sets of nine drawings are produced presenting iterative design changes based on the minimal possible alterations to maintain the integrity of the base drawings.

Figure 70. Nine drawings of minimal interior space.

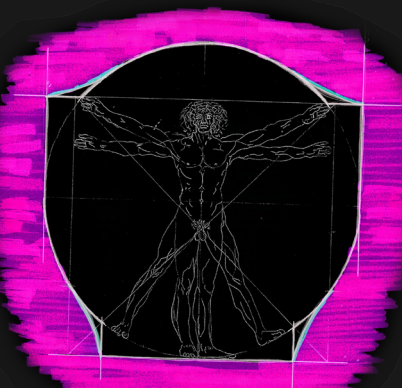
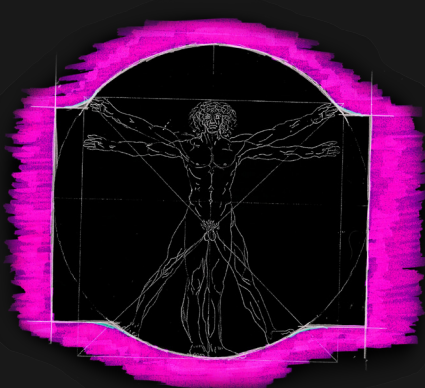
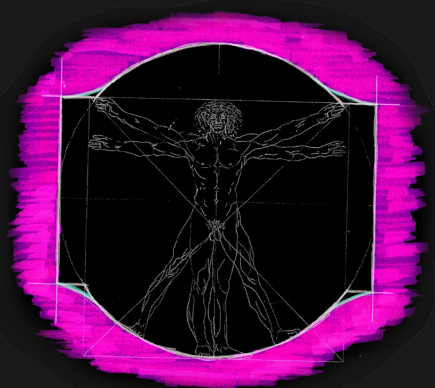
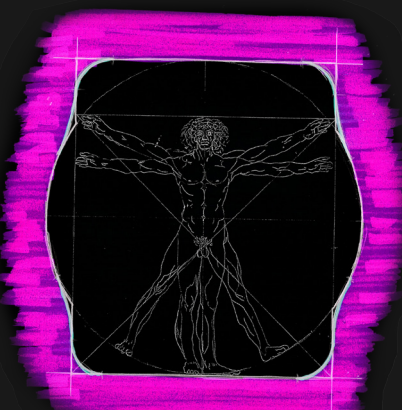
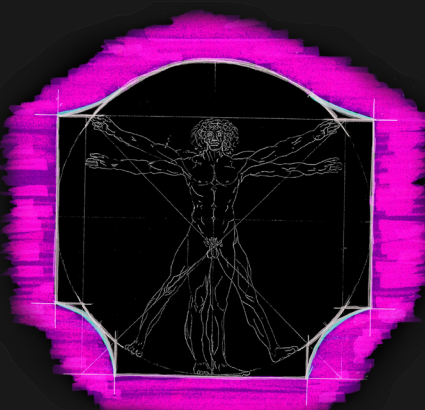
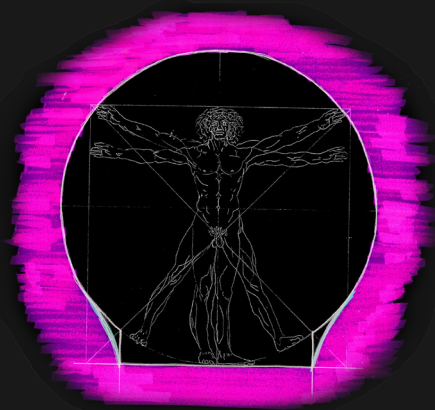
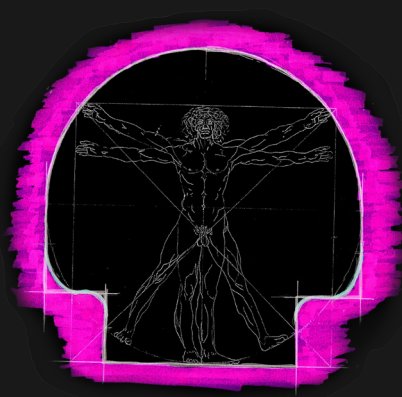
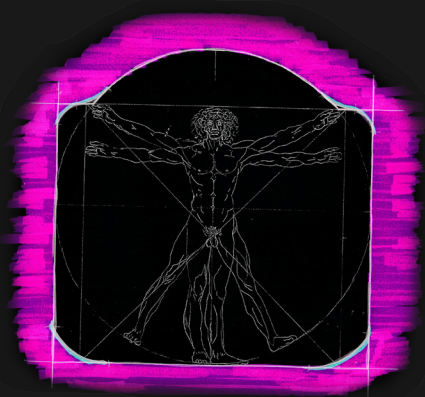
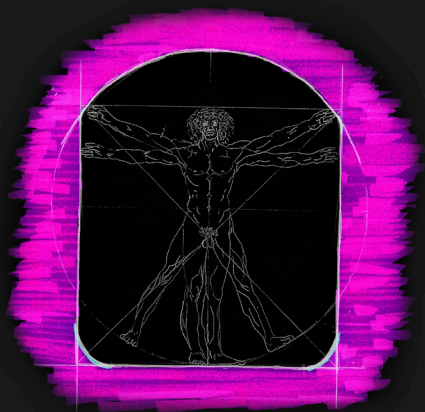




## Symmetrical Edges

For the first set of iterations, the edges and vertices of the base drawings are altered using straight edges. The changes mirror each other to maintain symmetry along each drawing. Symmetrical change of edges creates smoother corners to provide the inhabitant the atmosphere of a comfortable space.

Figure 71. The first set of iterative drawings of minimal interior space .

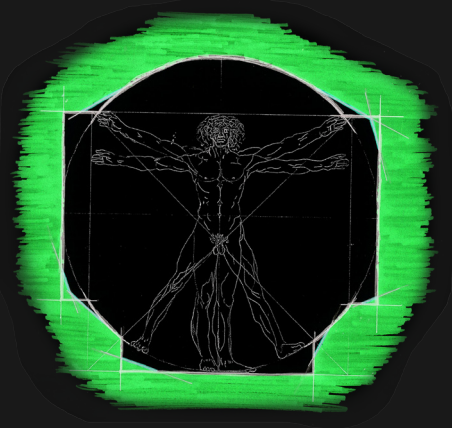
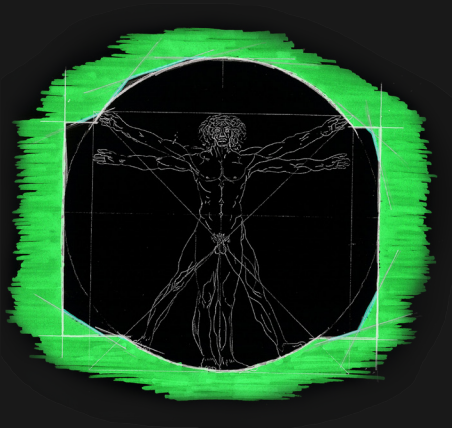
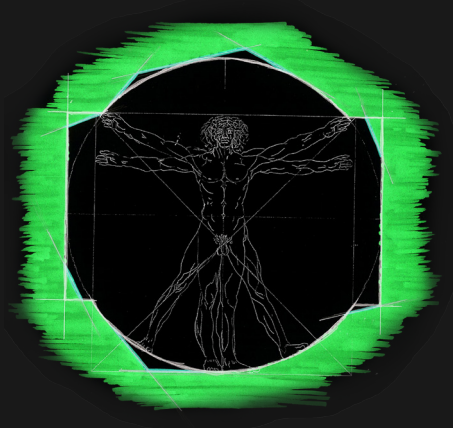
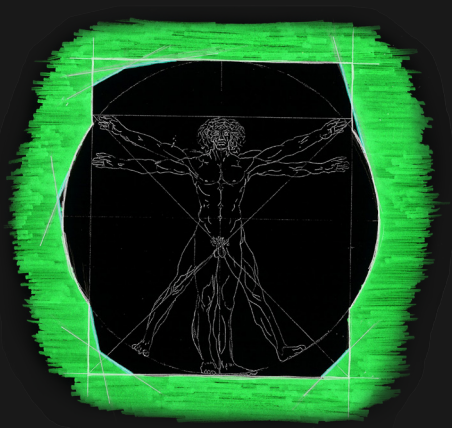
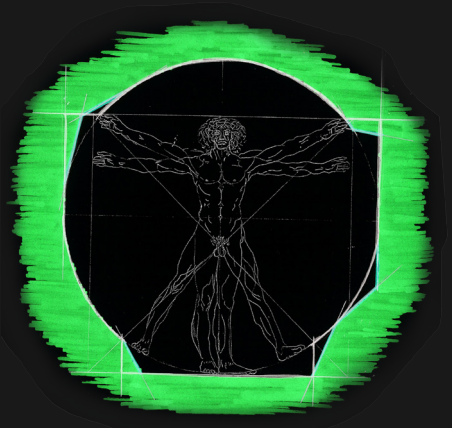
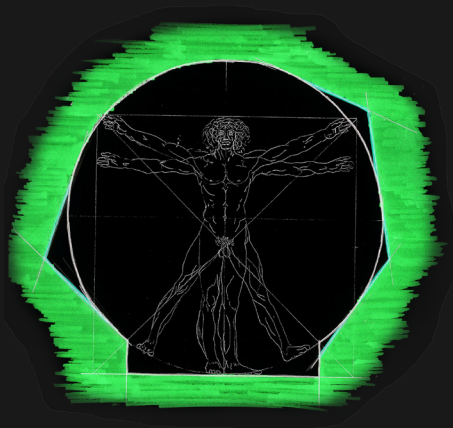
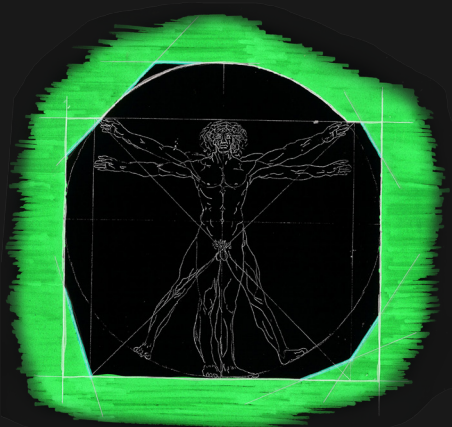
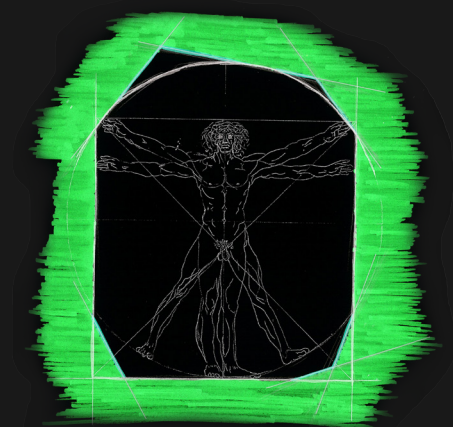


## Symmetrical Curves

For the second set of iterations, all of the vertices in base drawings are smoothed along to the edges. The changes mirror each other to maintain symmetry along each drawing, much like the first set. The symmetrical curve's alteration exudes a seamless space as well as a comfortable atmosphere within the drawings.

Figure 72. The second set of iterative drawings of minimal interior space.



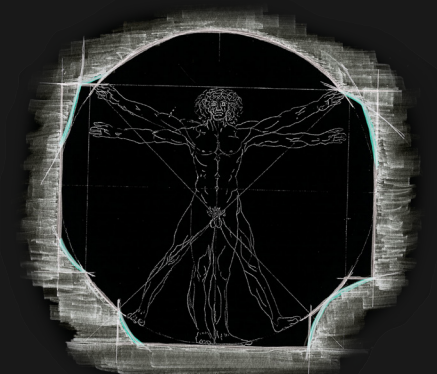
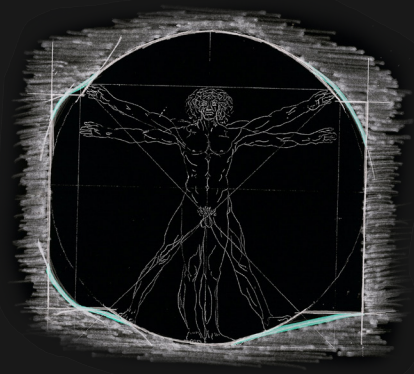
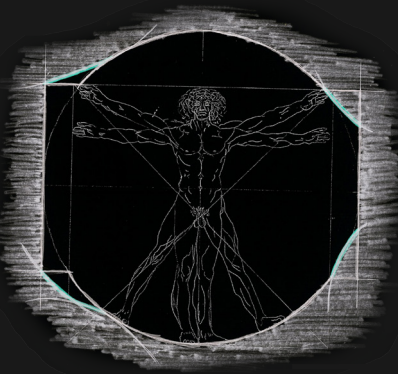
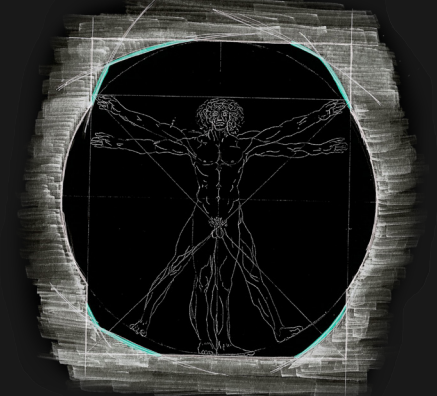
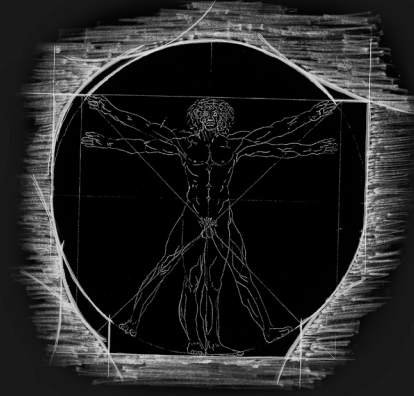
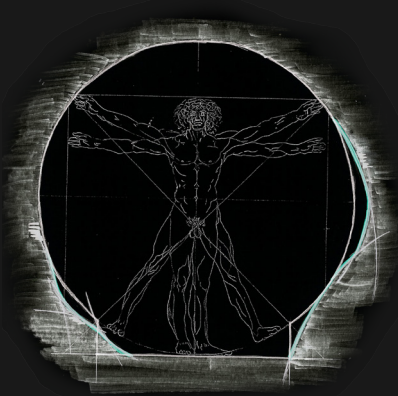
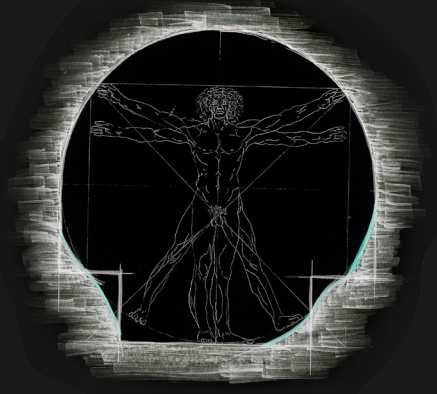
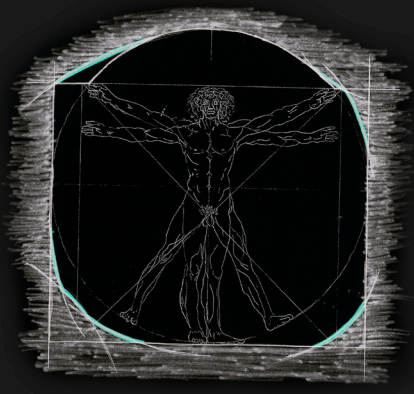
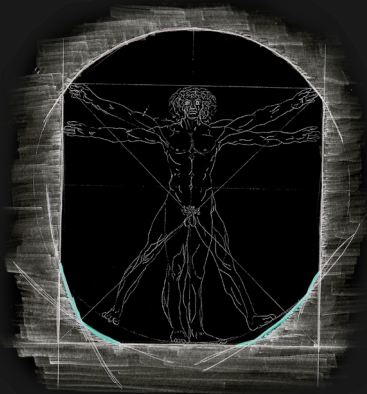


## **Asymmetrical Edges**

Similar to the first set of iterations, the third set includes the same type of alterations on the base drawings; however, the vertices and edges share now symmetrical relationships. The asymmetrical alterations provide the drawings with a more non-organic form while maintaining a comfortable atmosphere within each space.

Figure 73. The third set of iterative drawings of minimal interior space .





## **Asymmetrical Curves**

The last iterative set is similar to the second set with the curve alteration of each vertex in the base drawings; however, the changes are all asymmetrical to each other. This asymmetrical alteration insinuates a more organic space, unlike the third set, and maintains the comfortable atmosphere present in all the other sets.

Figure 74. The fourth and last set of iterative drawings of minimal interior space .



## **Self-Critique and Interim Reviews**

This experiment yields the most influential results out of all the experimentations. The experiment provides an efficient method to determine the optimal form for the proposed design's interior by utilising a human's maximum span to determine a generally comfortable interior. Out of all of the iterative drawings from each set, only the following five demonstrate potential for development. None of the asymmetrical drawings can be considered viable since the asymmetrical nature of these drawings makes it hard to connect with other similar modules. The five chosen drawings not only retain a comfortable and non-obstructive form, but also provide potential working space for the necessary functions for a minimal dwelling. Although the final form for the proposed design may not be one of these drawings, they will most certainly influence its development, both the interior and the exterior forms.

Based on several critiques from interim reviews, the main concern about the experiment and the development of the design through this experiment is the overall dimensions for the proposed design. Since the experiment only shows cross-section drawings, it is difficult to grasp the whole dimension of the space. One of the critics advised the student to pay attention to the dimension required not only by the inhabitant by themselves, but the recommended dimensions for the necessary functions for a minimal dwelling as well since each function has different required space for the most optimal use possible.





## CHAPTER SIX

THE HEDRAPOD SERIES





This chapter concentrates on the major design study commenced during this thesis. It is an interior architectural study that examines and contests many of the issues and opportunities alluded to in the previous chapters. It exists as further research to assist in finalising the available solutions in the design and the implementation of alternative minimal dwellings in a future urban area.



## **6.1 DESIGN INTENTION**

The design study was commenced as a response and reaction to the topics raised by the case studies in Chapter Four, and under the influence of the results yielded by the experiments in Chapter Five. It attempts to depict new philosophies and addresses future issues inherently present in metropolises and minimal dwellings, and the potential of emergent technology as design generating tools identified in Chapter Two.

The design study encompasses the components established by the previous chapters – ethnic and cultural diversity, the urban demographic, urban emergent technologies in the future, urban living wants and needs, and interior space usage of urban dwellings.

## European



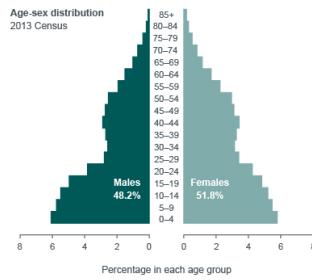
74% Proportion of people who identified with at least one European ethnicity in 2013

+14% Increase since 2006 in the number of people who identified with at least one European ethnicity

41.0 years Median age of people who identified with at least one European ethnicity in 2013



## Māori



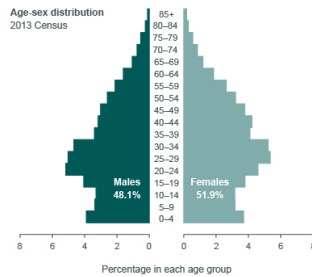
15% Proportion of people who identified with Māori ethnicity in 2013

+6% Increase since 2006 in the number of people who identified with Māori ethnicity

23.9 years Median age of people who identified with Māori ethnicity in 2013



## Asian



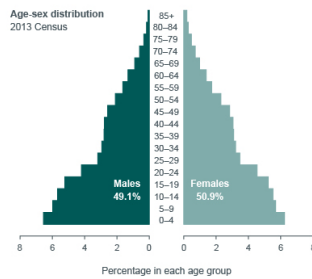
12% Proportion of people who identified with at least one Asian ethnicity in 2013

+33% Increase since 2006 in the number of people who identified with at least one Asian ethnicity

30.6 years Median age of people who identified with at least one Asian ethnicity in 2013



## Pacific peoples



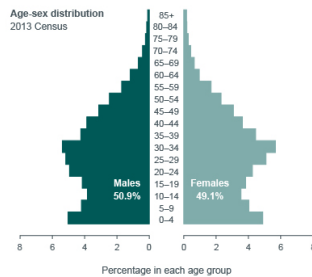
7% Proportion of people who identified with at least one Pacific ethnicity in 2013

+11% Increase since 2006 in the number of people who identified with at least one Pacific ethnicity

22.1 years Median age of people who identified with at least one Pacific ethnicity in 2013



## Middle Eastern / Latin American / African (MELAA)



1% Proportion of people who identified with at least one MELAA ethnicity in 2013

+35% Increase since 2006 in the number of people who identified with at least one MELAA ethnicity

28.6 years Median age of people who identified with at least one MELAA ethnicity in 2013

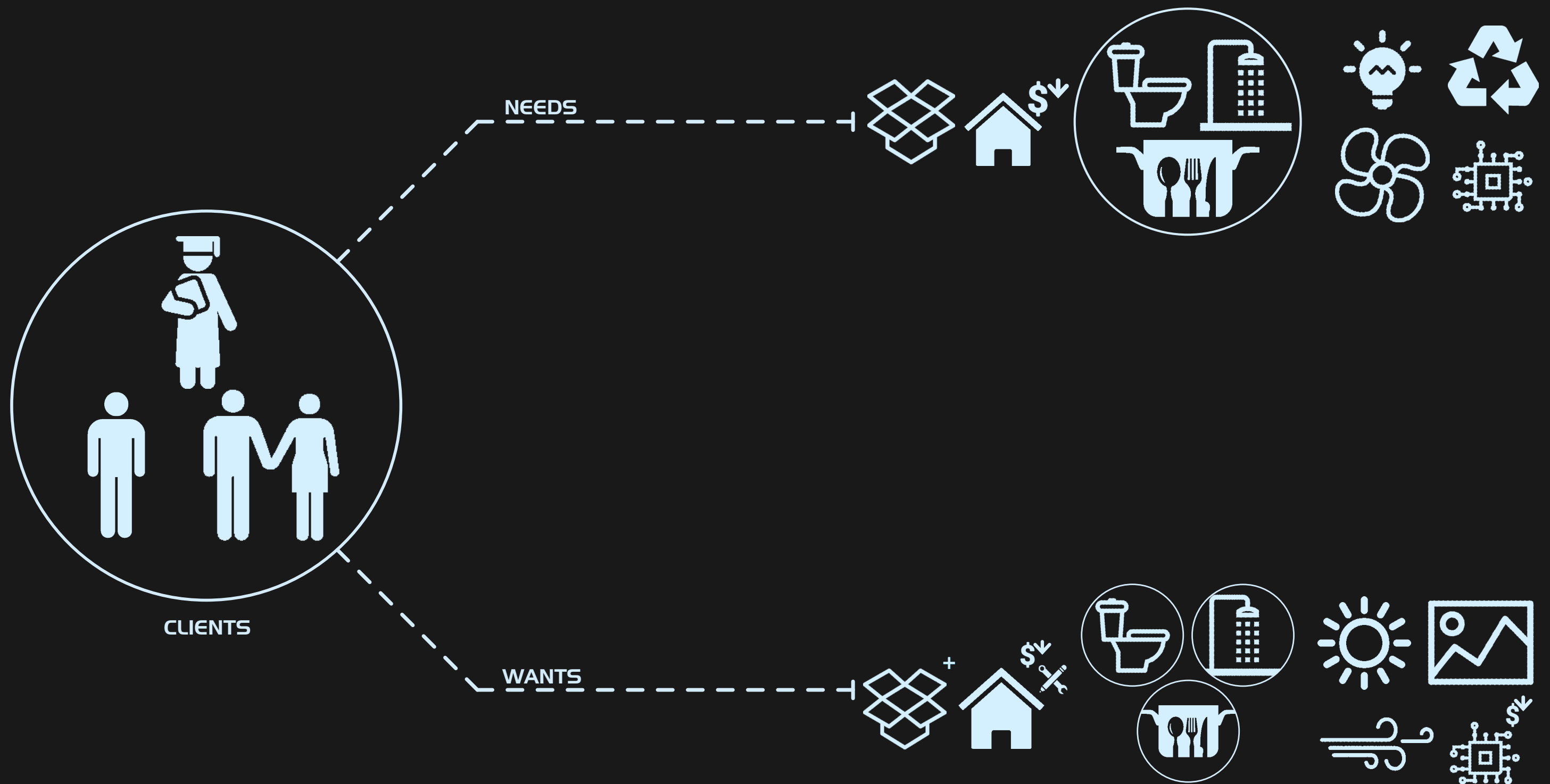


## Ethnic and Culture Diversity

Due to immigration, current metropolises around the world are inhabited by populations with diverse ethnic backgrounds. According to the 2013 New Zealand Census, 74% of the country's population identified themselves with one or more European ethnicities. The remaining percentage identified themselves belonging, fully or partially, in other major ethnic groups such as Maori (14.9%), Asian (11.8%), Pacific peoples (7.4%) Middle Easter, Latin American and African (a total of 1.2% for the three) ("2013 Census QuickStats about culture and identity," 2014). With the growth in all major ethnic groups since the last census in 2006, it is expected that the population growth will continue to grow in the future, thus making it difficult to provide an urban dwelling capable of catering for most, if not all, of the ethnic groups present in New Zealand. The design study acknowledges this situation and attempts to explore physical space with the capability of adapting to the inhabitant's individuality.

Figure 75. Major ethnic groups in New Zealand according to the 2013 New Zealand Census.





Figures 76. A diagram of the design study's clients, and their wants and needs in a dwelling.



## The Urban Demographic

According to the 2013 New Zealand Census, the average number of usual residents in a household is 2.7 per household; 23.5% are one-person households and 4.8% are another multi-person household ("2013 Census QuickStats about families and households," 2014). The most predominant family type in the country was couples with child(ren), with Auckland having the highest percentage of couples with children at 46.5% followed by Wellington at 42.0% and Canterbury at 40.5% (Idem). Although the statistics indicate that the major cities in New Zealand are mainly inhabited by one-family households comprised of couples with child(ren), the figures combine both urban and suburban inhabitants with the latter comprising the majority of the figures suggested by the data. Urban inhabitants, on the other hand, would most likely be comprised of university students and young professionals, either a one-person or a multi-person household. The design study explores this condition and intends to address the need for urban dwellings for inhabitants intending to live within the urban centre who only have the means to support themselves rather than a one-family household of more than two people.

Figure 77. The target clients of the design study.



WANTS



NEEDS

## Urban Living Wants and Needs

Within any living space, there are certain elements relating to the inhabitant's overall experience, comfort and well-being prioritised over others. American psychologist Abraham Maslow proposed "A theory of human motivation" regarding the hierarchy of needs after observing humans' innate curiosity, which he represented as a pyramid with the more basic needs at the bottom (Maslow, 1943). In his paper, Maslow classified the hierarchy of needs into five levels describing the pattern through which human motivations generally move: starting from bottom – 'physiological', 'safety', 'belonging and love', 'social needs' or 'esteem', and 'self-actualisation'.

- Self-actualisation needs consist of morality, creativity, spontaneity, problem solving, lack of prejudice, and acceptance of facts.
- Esteem or social needs consist of self-esteem, confidence, achievement, respect of others, and respect by others.
- Love and belonging consist of family, friendship, and sexual intimacy.
- Safety needs consists of security of body, of employment, of resources, of morality, of the family, of health, and of property.
- Physiological consists of breathing, food, water, sex, sleep, homeostasis, and excretion (Idem).

The physiological needs of humans can be considered as the basic functions any dwelling should be able to provide for its inhabitant/s. Maslow's depiction of human physiological needs align with what *existenzminimum* considers the bare necessities required to provide in an *existenzminimum* dwelling (Bevilacqua, 2011), indicating that urban living requires to provide the physiological needs stated by Maslow's theory. Anything other than the need previously stated should be considered as the inhabitants' wants, which may vary for each inhabitant and may contain, but not be limited to, larger space for storage, functions and circulation, natural lighting and ventilation, and personalised spaces. The design study addresses the needs and wants of urban inhabitants in the future based on the standards set by *existenzminimum*, Maslow's human physiological needs, the existing urban living issues presented by the case studies, and the expected technological differences in the future based on current emergent technologies.

Figure 78. The target clients' wants (top) and needs (bottom).



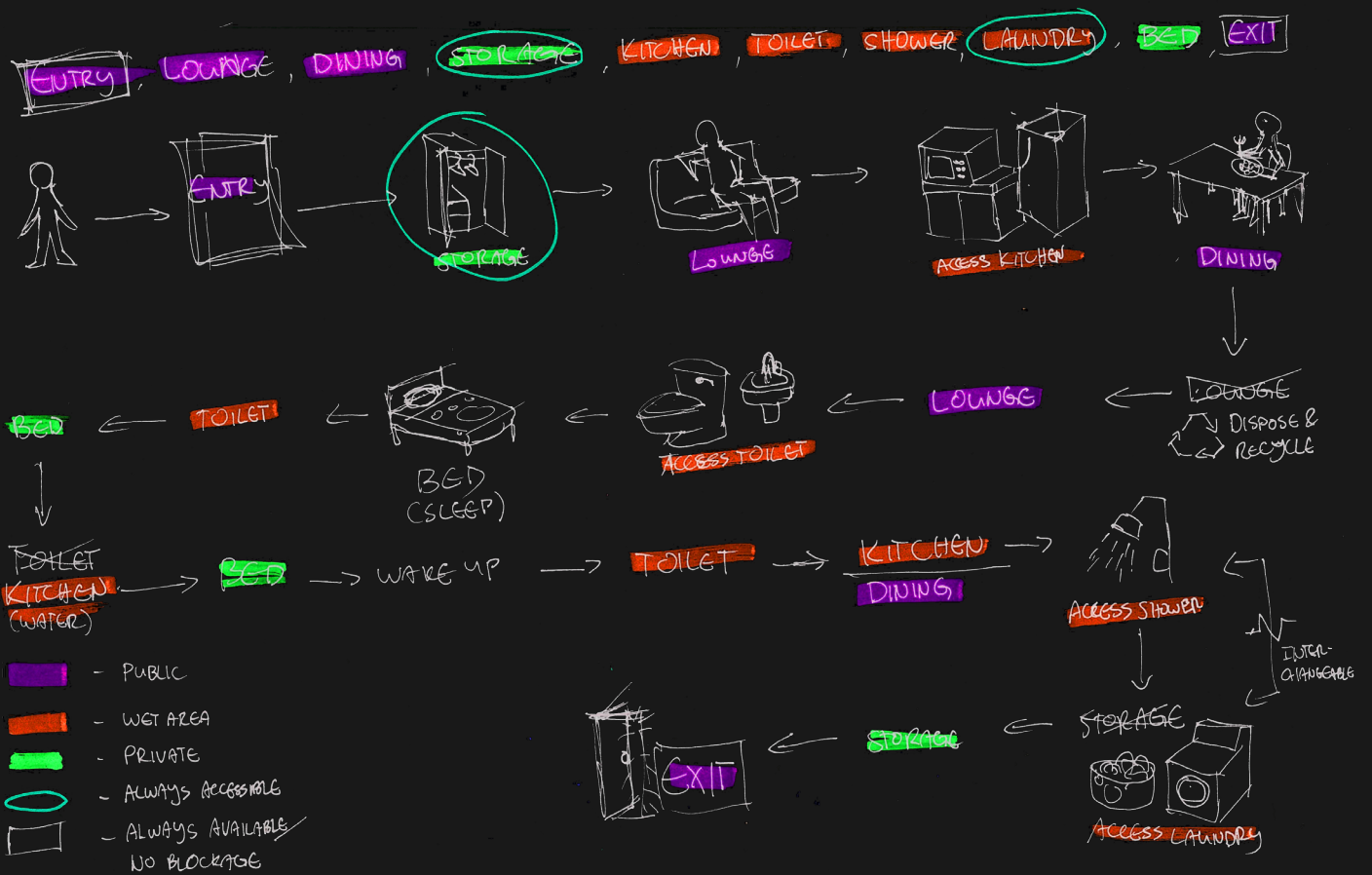


## Urban Emergent Technologies in the Future

With the increasing advancement in technology within the last decade, architecture worldwide must adapt to consolidate with emerging technologies to further improve user experience, well-being and comfort. Commercial virtual and augmented reality headsets are becoming commonplace within households as the global VR market continues to grow at a constant rate, "valued at USD 3.13 billion in 2017 and is expected to reach USD 49.7 billion by 2023, at a CAGR of 58.54% over the forecast period (2018-2023)" ("Global Virtual Reality Market Size 2018: Growth Analysis, Technology Trends, Key Features, Statistics, Types, Applications and Outlook 2023," 2018). Aside from VR and AR, other technologies such as remote control of functions, wireless connectivity for all devices, multidirectional elevators, and automated functions are being implemented in dwellings and buildings to improve inhabitant comfort, experience, and well-being, while technologies such as robotics, 3d printing, and parametric design help produce and shape the structure, form and circulation of any building typology. It is expected that most households in the future will contain most, if not all, of the listed technologies within the dwellings, and be designed and constructed through the use of some of the listed technologies. The design study investigates the potential of emergent technology as design generating tools by generating forms capable of containing certain emergent technologies potentially required for future urban living, all without jeopardising the minimal aspect of minimal dwelling.

Figure 79. Wireless charging pads for mobile devices.

Figure 80. Amazon Alexa used for wireless connectivity to mobile devices and the internet.



## Interior Circulation in Urban Dwellings

With the diverse ethnic and cultural urban population, it is safe to assume that each inhabitant will have similar and different circulation patterns when using an interior living space. Maslow's theorised human physiological needs indicate that people must eat, sleep, relax or stabilise, breathe, excrete, and sanitise or remain salubrious, and based on this theory (Maslow, 1943), it can be presumed that functions pertaining to these needs are necessary for any dwelling. With that said, urban inhabitants all require access to the same type of functions, cannot be omitted in any dwelling, and share the same or similar circulation pattern. The arrangement of functions within a dwelling may dictate the impression given by the interior space's circulation, since the location of each function may affect the cohesive flow from the shifts in functions. Hypothesising how an inhabitant may use an interior living space should be possible based on Maslow's physiological needs and *existenzminimum's* basic requirements for an *existenzminimum* dwelling. The design study challenges the format of an urban dwelling's interior circulation by producing a hypothetical typical interior circulation for an inhabitant while they occupy the space. This circulation is formed under the premise provided by Maslow's physiological needs and principles of *existenzminimum*, and will be impartial in order to associate the circulation with how the majority of the inhabitants would most likely circulate within a dwelling.

Figure 81. Daily interior circulation of the target clients in an urban dwelling.

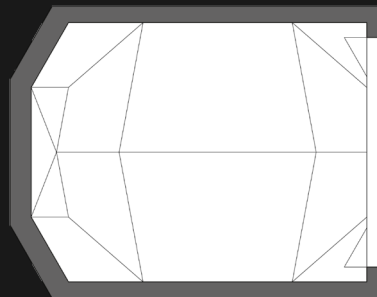
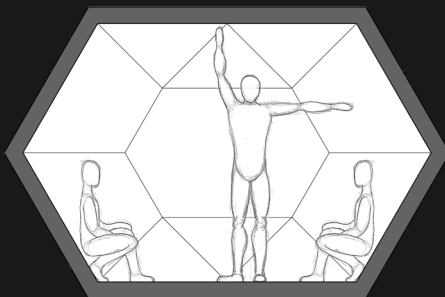
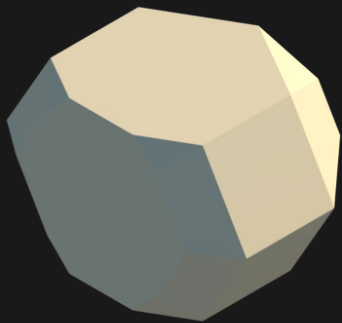
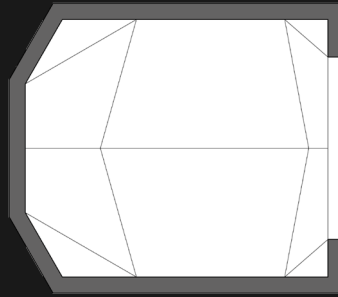
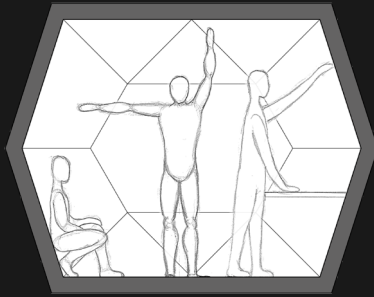
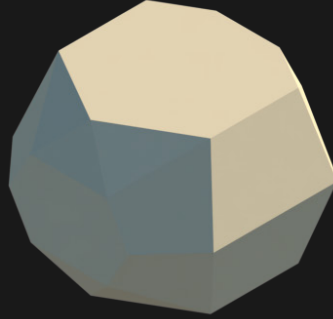
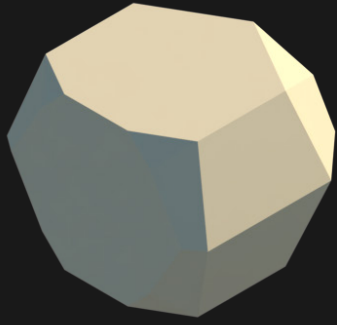
Considering all of the aforementioned components is crucial to initiate an alternative to urban minimal design in the future, since it will depict the characteristics of the proposed design.



## 6.2 INITIAL DESIGN RESPONSE

In a future city centre brimming with emergent technology and urban living issues, the urban minimal dwelling will need to alter its physical and structural form to adapt to its environment and provide the necessary needs and desirable wants of its inhabitants – an alternative to conventional urban minimal dwelling utilisable for future urban living. It is expected to maintain a minimalistic space for the inhabitant to move around, more than sufficient sized spaces for storage and the necessary functions, and have the capability to expand to provide more space for the inhabitant if and when necessary.

For the initial design iterations, the maxi-minimal of the inhabitant's space was the main focus; according to the findings from the case studies and literature reviews, prioritising the inhabitant's space is crucial to developing a minimal dwelling since this will influence the storage and functions' layout and spatial size. Prioritising the inhabitant's immediate space also assists with inspiring the exterior form of the entire dwelling by defining the inhabitant's maxi-minimal space first. The design's exterior form becomes easier to determine through establishing the maxi-minimal limit for each function and storage spaces.

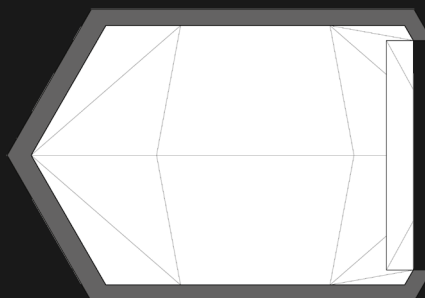
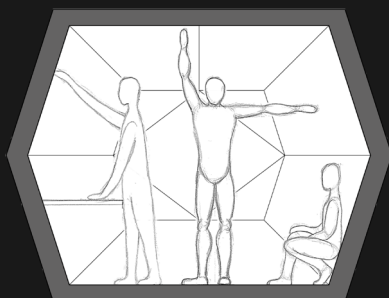
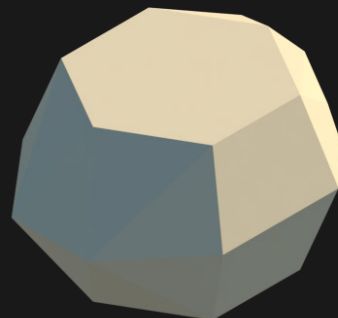
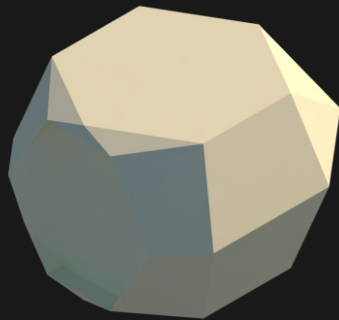
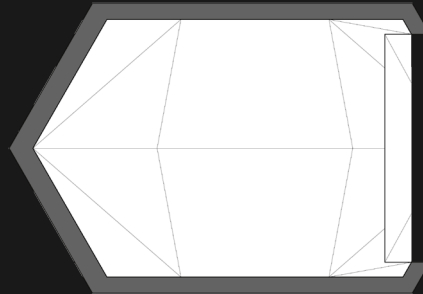
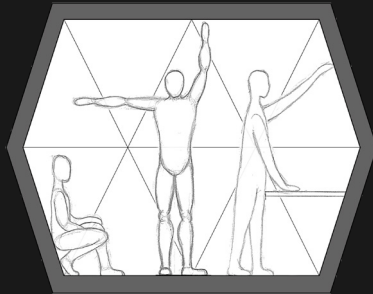
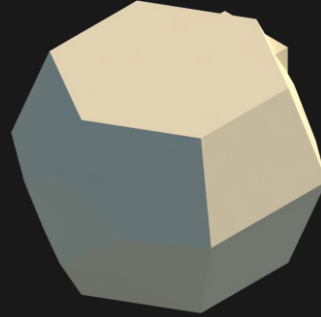
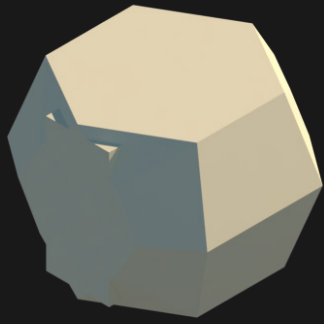




## Iteration One

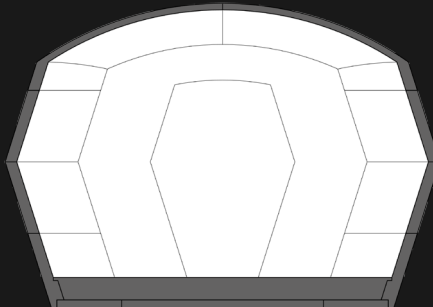
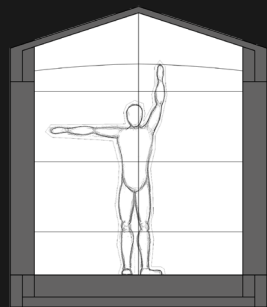
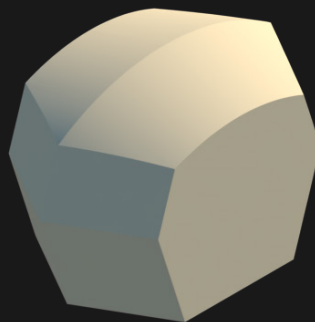
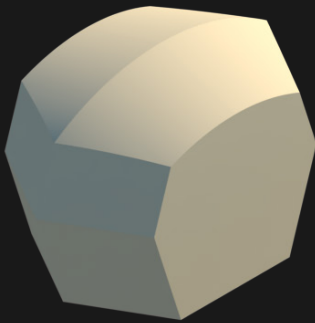
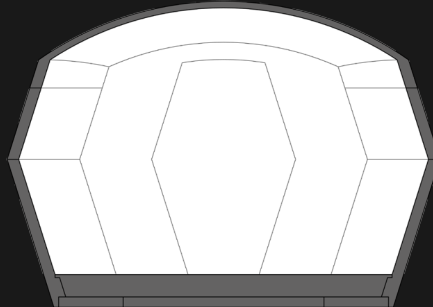
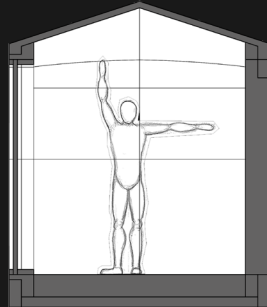
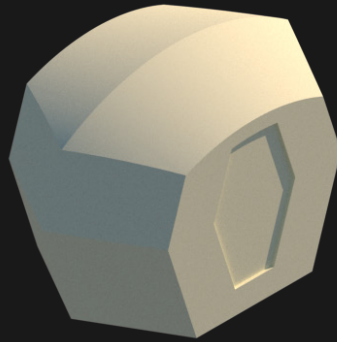
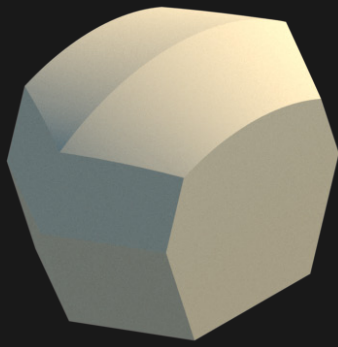
The first design iteration is a collection of similar modules with varying entrances. Expansion to provide more space was not utilised for this iteration since establishing the maxi-minimal space for the inhabitant takes more precedence at this stage. The iteration examines the potential of polyhedral interior forms since polyhedrons offer natural planar surfaces usable as a floor, ceiling and walls. The entrances for each model differ from each other in order to explore possible approaches for the space's entrance as well as the connection methods between the dwelling, other similar modules, and the structure bearing the modules.

Figure 82. The first (top) and second (bottom) modules of the design study's first design iteration.



The first module showed promise as a maxi-minimal space for the inhabitant by providing a space capable of allowing the inhabitant to perform actions without hindrances. The wall, ceiling and floor dimensions are as minimal as possibly to cater for the inhabitant without sacrificing comfort and salubrity, and the polyhedral form allows for smoother modular arrangements. The downside of the iteration, however, is that the provided space is so minimal, it will not be able to fit the required functions and sufficient storage spaces. In order to accommodate these components, it is necessary to enlarge the designed space twice its size at maximum.

Figure 83. The third (top) and fourth (bottom) modules of the design study's first design iteration.

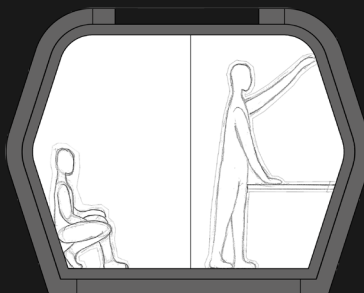
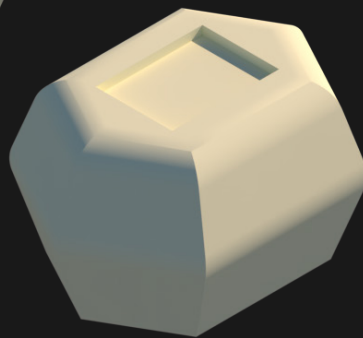
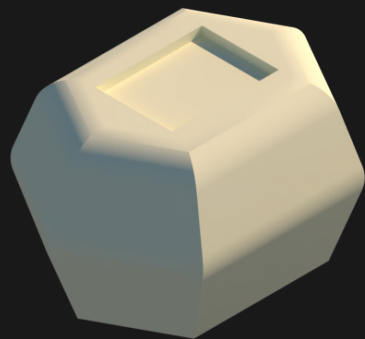
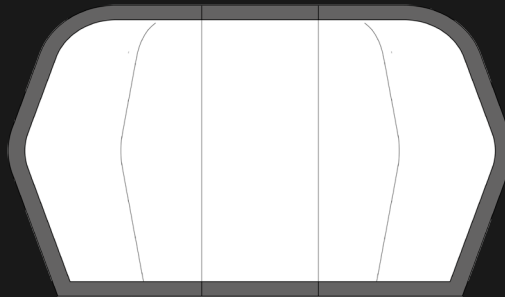
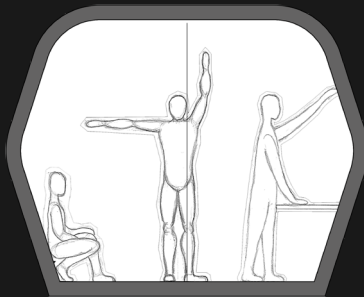
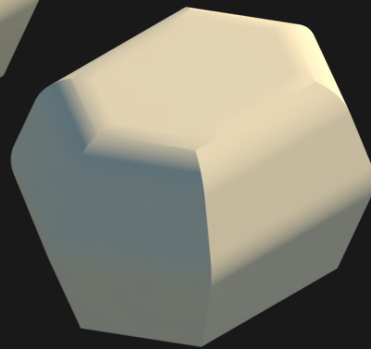
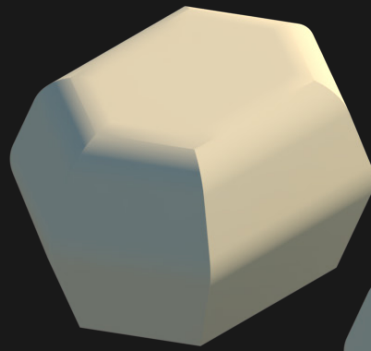


## Iteration Two

The second design iteration is a pair of similar modules in response to the outcomes of the first design iteration. Much like the previous iteration, expansion to provide more space was not used as establishing the maxi-minimal space for the inhabitant still takes more precedence. The iteration examines the potential of curved three-dimensional interior form. The entrances for both modules are located on a perpendicular wall face to allow a quick and natural transition between the interior and exterior, and provide a face to connect to the structure. Unlike the previous iteration, the modules are only able to connect along the perpendicular faces and nowhere else.

The second iteration had the least potential for development overall. The irregular interior form made it difficult to attach to similar modules since only two faces are viable for connecting, and the entrance to the space is located in one of the two faces. Another downside of the form is that there are only two workable faces in which the required functions are placeable, and one of them contains the entrance. The corner ends of the modules are problematic since any attempts to position a suitable function would look awkward. Perhaps the only positive element about the iteration provided is insight about the need to have a minimal interior form with multiple planar faces to make it easier to position functions and storage spaces along them.

Figure 84. The first (top) and second (bottom) modules of the design study's second design iteration.





## Iteration Three

The third design iteration is a pair of similar modules derived from the second design iteration and responds to the flaws of the second iteration. Much like the first iteration, the modules have a polyhedral form to provide modular connectivity with similar modules and the structure supporting the modules. For one of the modules, the ceiling houses a double bed that drops down when required to be used. The modules also expand more than half of their length in order to provide more space for the inhabitant when necessary. Although the entrances for the modules were not included in this iteration, the end caps have potential for the placement of the entrances since situating the entrance in one of these end caps offers a more direct circulation within the module.

The third iteration showed more potential for further development compared to the previous iterations. The polyhedral interior form is less restrictive compared to the previous iterations, provides better opportunities for positioning the required functions and storage spaces, and allows for better modular and structural connectivity with other similar modules and the structure supporting them. The maxi-minimal space is adequate for the inhabitant, providing a comfortable and salubrious space while keeping the space within minimal dimensions to circulate around.

Figure 85. The first (top) and second (bottom) modules of the design study's third design iteration.



## Self-Critique and Interim Reviews

Overall, the initial design response solidified a foundation for the development of an alternative to urban minimal living in the future. Establishing the threshold for the maxi-minimal space and translating it into a distinguishable form required a lot of revision and testing due to the varying heights of people. By the end of the iteration process, the *Architects' Data* by Ernst Neufert became an important guide throughout the rest of the development process for standard dimensions and requirements for everything related to architectural design—from Le Corbusier's *Le Modulor* to varying standard dimensions of every component in a bathroom, to the informative dimensions regarding specific human activities and their immediate space (Neufert, 2012).

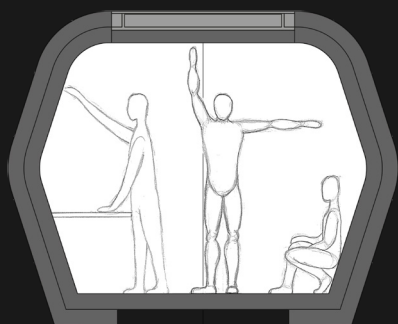
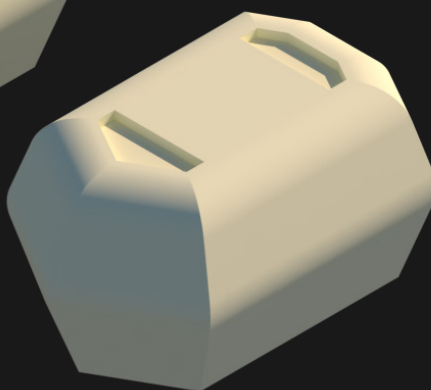
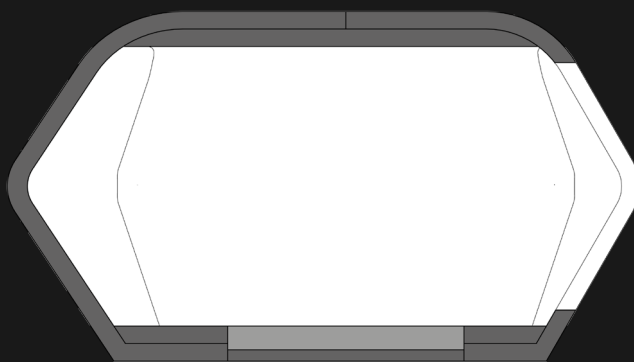
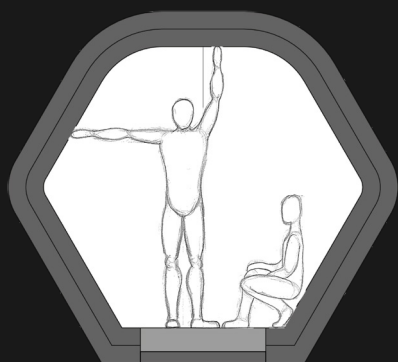
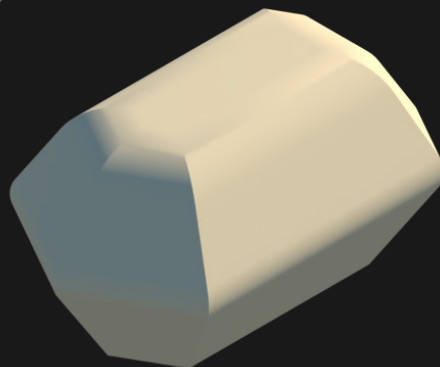
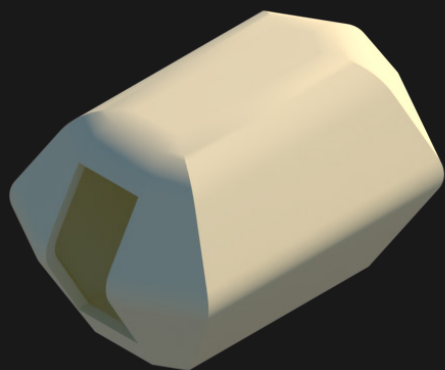
The most demanding process during the conception of the iterations was associating and assorting where the necessary functions and storage spaces would be positioned along the iterations. This was also the concern brought up by a critic from one of the interim design reviews regarding the design iterations. The resolution for this concern is to start including these elements when developing the initial design. Along with the inclusion of the functions and storage, maintaining the same, or approximately similar, maxi-minimal size suggested by the iterations is another demanding process during the iteration. This may remain even when the functions and storage spaces are included in the design since each have their own required dimensions to yield a comfortable and salubrious space for the inhabitant. To mitigate this concern, the maxi-minimal dimension threshold needs to be adjusted to fit both the inhabitant's maximum span and the most acceptable minimal dimension requirements for the functions and storage spaces.



## 6.3 THE HEDRAPOD SERIES

After analysing, critiquing, and revising the three design iterations, the design study reached a point in development where it is ready for further development – namely the inclusion of functions, storage space and materials. The HedraPod series are the developed designs crafted from the results of the iterations, using Neufert's *Architects' Data* as the main guide and information about specific emergent technologies as other guides to acclimate and develop the proposed alternative to urban minimal dwelling in the future.

Each HedraPod design is developed from the initial design iterations and the first design of the series, HedraPod 01.



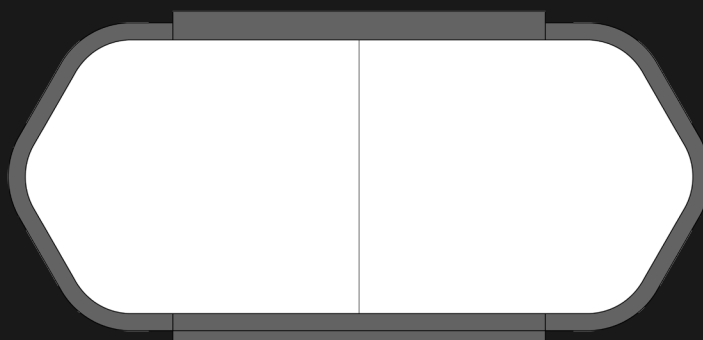
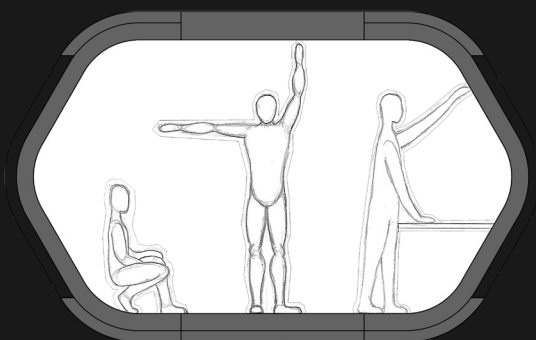


## HedraPod 01

An amalgamation of the previous design iterations, HedraPod 01 is established as the base form for the series. Made up of a pair of slightly similar modules, the design focuses on establishing the maxi-minimal space for the inhabitant and its dimensions during its expanded and non-expanded state. Both modules contain a double bed accessible using different methods and an entrance leading into the space. The first module is an equilateral hexagon-based polyhedron with a flat linear floor, curved angular walls and ceiling. The double bed is hidden under the floor and rises up when it is to be used. The module is capable of comfortably fitting one person in both its non-expanded and expanded forms. The second module is a wide hexagon-based polyhedron with curved angular walls and flat floor and ceiling. The double bed drops down from the ceiling when it needs to be used, similar to the other module. The module is capable of comfortably fitting a maximum of two people during its non-expanded form and a maximum of six people during its expanded form. Both modules connect to the same forms and are capable of cross-connectivity between each other.

HedraPod 01 provides more practical dimensions compared to the design iterations. The variety in the module sizes presents options for the target maxi-minimal space; based on how both modules performed, a space capable of fitting in a maximum of two people should be the target for the next series of designs. Although most of the functions and storage spaces are not included in the conceptualisation of the modules in this series, the overall dimensions of the forms are still based on the minimum dimensions required for the necessary functions and storage spaces according to the information found in the *Architects' Data* (Neufert, 2012). In an interim design review, a concern brought up by a critic who practices professionally was the changes in angles for the modules, especially for the floors and walls. According to the critic, this design choice may be detrimental to the modules' structural integrity since applying force at varying angles may induce coupling issues, thus resulting in modules breaking apart at the joints. For the next series, the modules will infer the outcomes from HedraPod 01 and attempt to improved the proposed design.

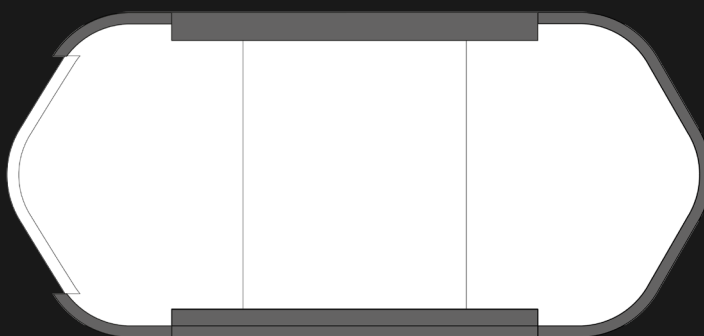
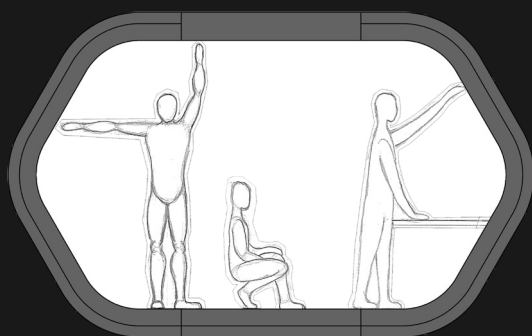
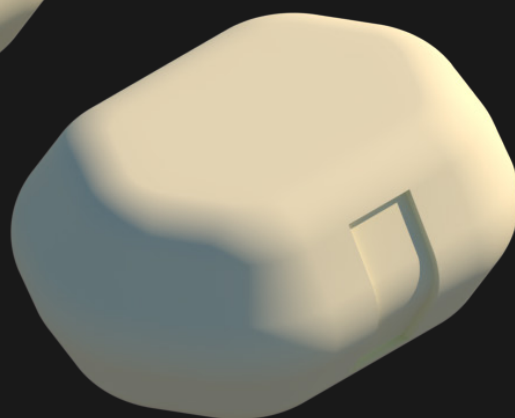
Figure 86. The first (top) and second (bottom) modules of HedraPod 01.



## HedraPod 02

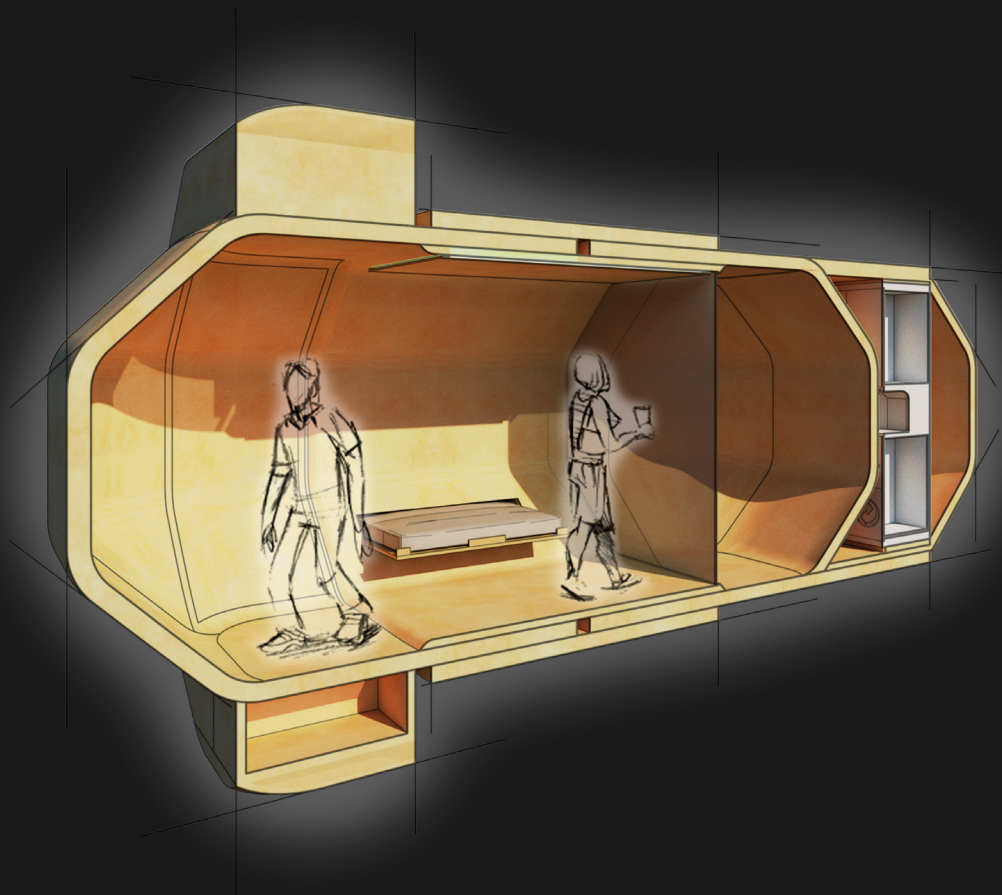
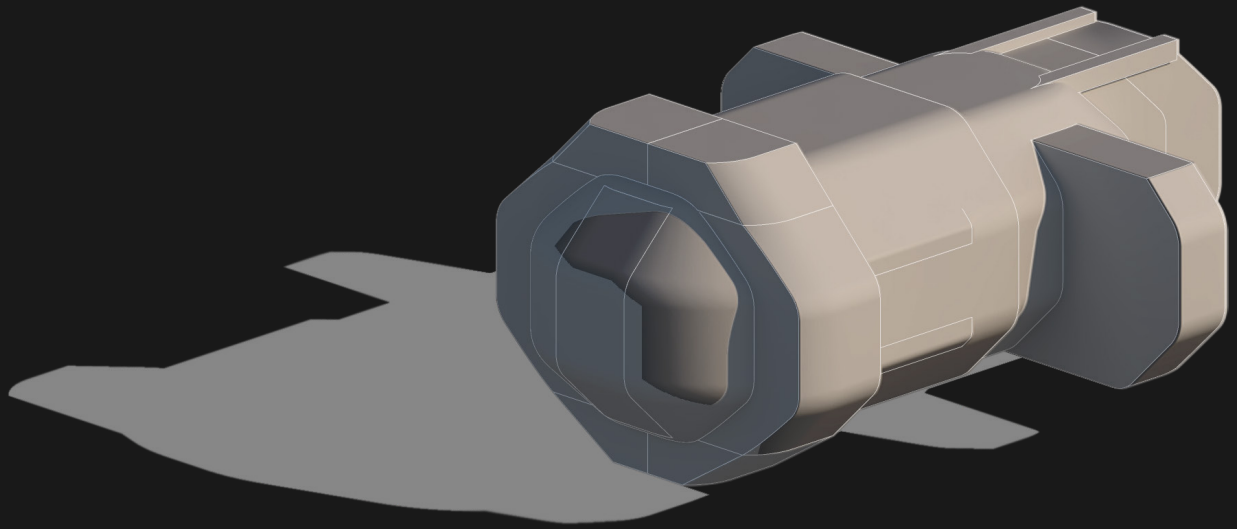
Utilising HedraPod 01 as its foundation, HedraPod 02 consists of two similar models and can be considered as enlarged versions of one of the HedraPod 01 modules. The increase in width is the result of attempting to accommodate the majority of the functions within the space at the same time. This not only made the interior size larger, but also increased the maximum capacity of the space during its non-expanded state from two to four. Aside from the obvious enlargement, there are other notable changes from HedraPod 01. All of the joints now have the same angle, including the end caps, to maintain the structural integrity of the module. Another change in the module is the inclusion of a central piece that manages the expansion of the modules. Having this central piece ensures that the expansion and contraction processes remain smooth and unhindered by any external influences during the processes. The first of the two modules has the central piece outside the interior space in order to prevent inhabitants from tripping from the change in footing, while the second module has the central piece inside to maintain an easier connection with other similar modules. The double beds incorporated along the modules from the previous series are also removed in favour of storable air mattresses. Both modules are able to house a maximum of three people during its non-expanded phase and a maximum of six people when expanded.

Figure 87. The first module of HedraPod 02.



HedraPod 02 delivers itself as a slight improvement of its predecessor. Its able to address some of the weaknesses of HedraPod 01, but also create more difficulties as well. The main factor of these modules is that the size increases the non-expanded capacity by one and doubles it when expanded, something that teeters on whether or not these modules can be considered as minimal dwellings. Although this design choice is meant to include the majority of the necessary functions and storage space, it does not justify the need to have the modules to be this huge. An urban dwelling this large may not even be the alternate urban minimal dwelling anymore since it disregards the findings yielded by the research; therefore the size needs to be re-evaluated. The inclusion of a central piece to moderate the expansion process is beneficial and has potential for further development. Having the central piece offers the modules a more aesthetically-pleasing design and better structural stability overall, though the placement of this central piece needs reconsideration. It would be inconvenient to have them both inside and outside the interior space since having them on either side runs the risk of the inhabitants tripping due to the change in level. The equally angled walls and surface do provide a more structural stability to the modules; however, the angles themselves prove themselves slightly difficult to work with. The equilateral hexagonal form allows for better connectivity along with other similar modules; however, the interior gains several dead zones located at the horizontal joints of the space. Having these dead zones creates unused space, disregarding the research made in this thesis about the need to utilise any dead space for an optimal minimal dwelling. Re-evaluating hexagonal polyhedrons as the interior form will be assessed, and looking at the potential use of the hexagonal form as an exterior form, as well as another polyhedral form that is ideal for the interior form will be necessary for the next developed design.

Figure 88. The second module of HedraPod 02.



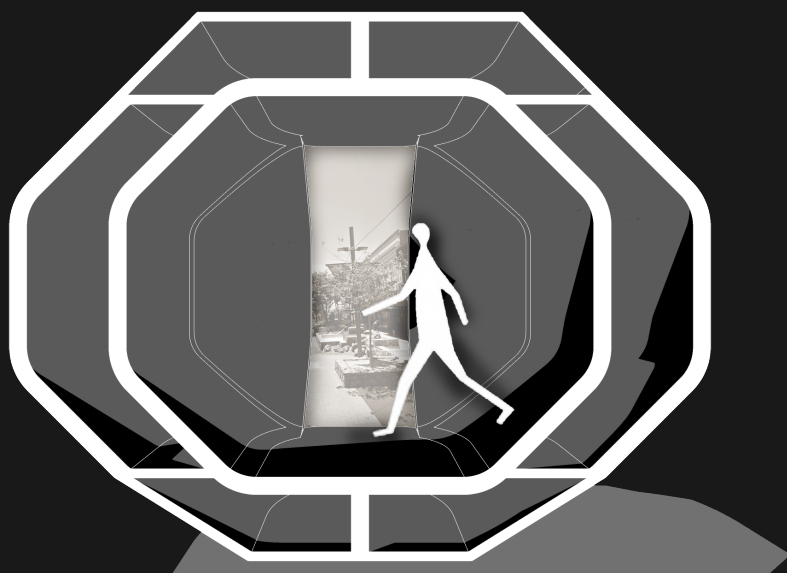
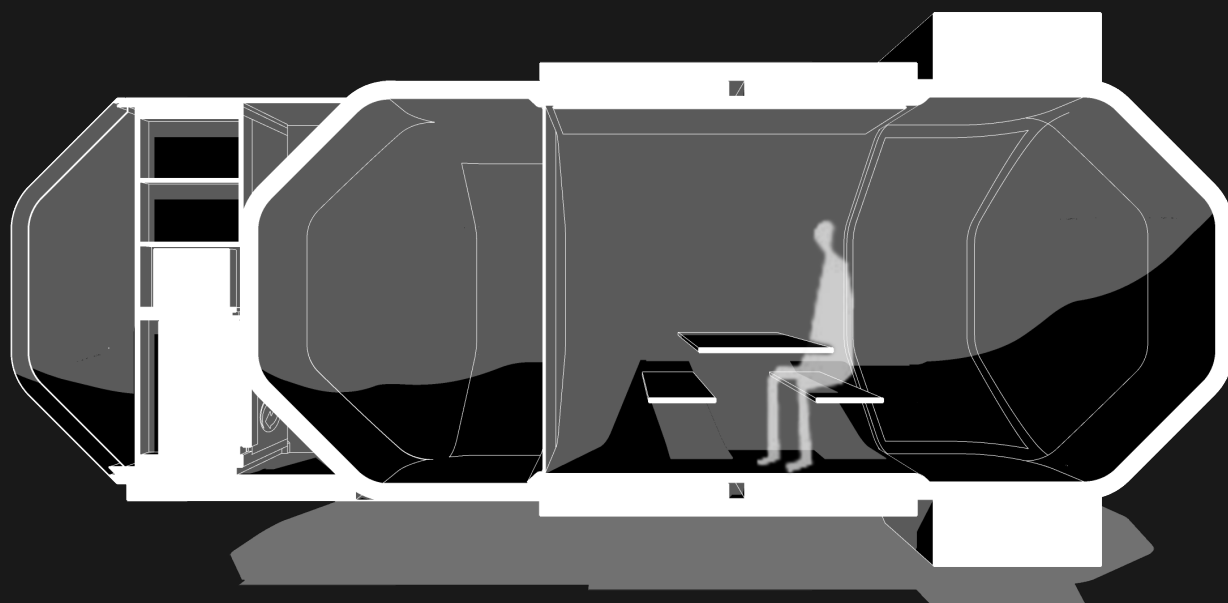
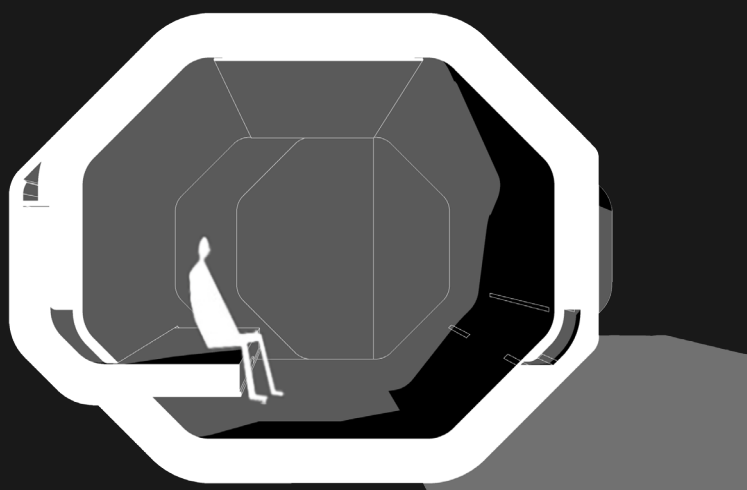


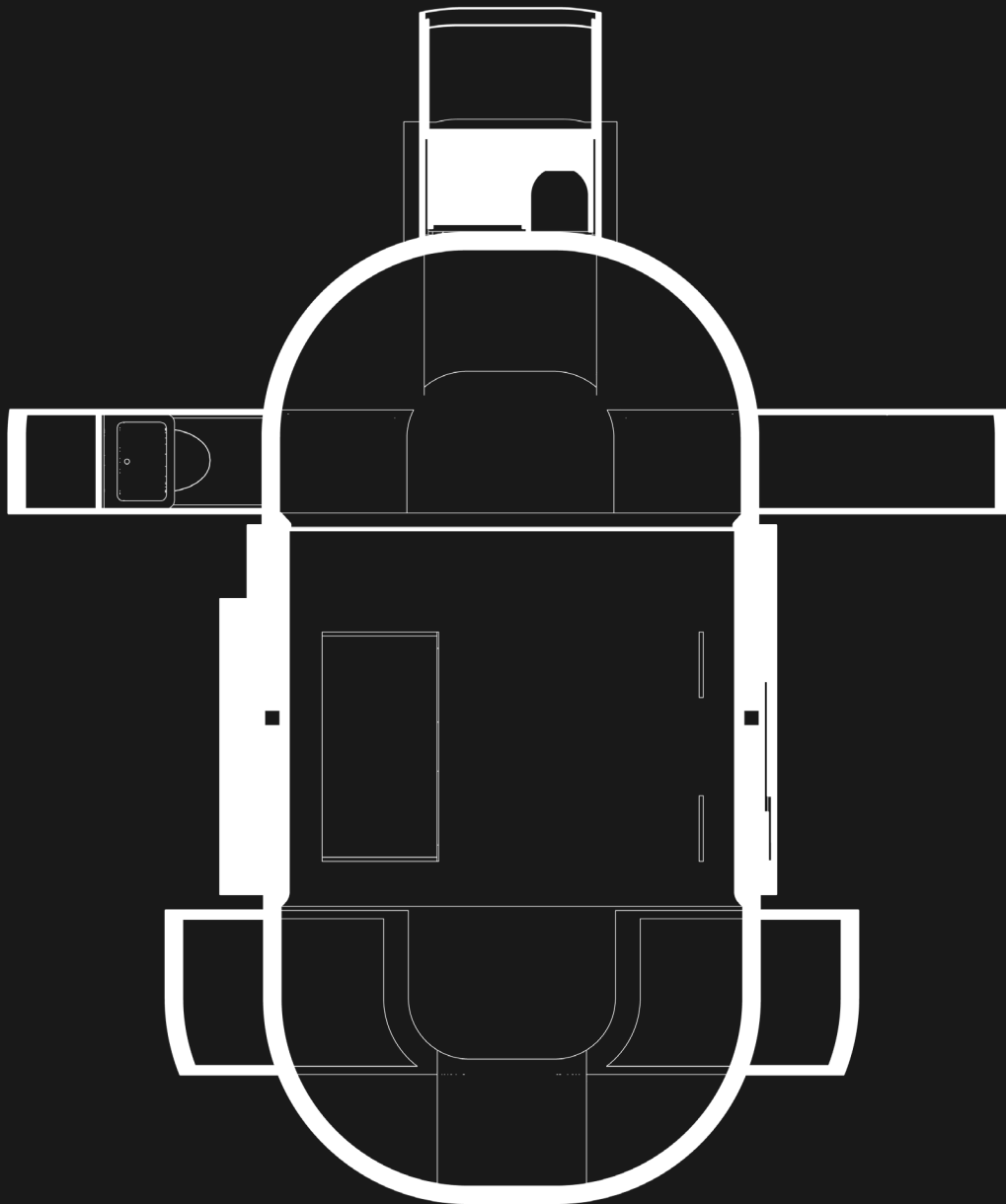
## HedraPod 03

After re-assessing the results from the previous modules, HedraPod 03 is a further development of HedraPod 02 and improves the previous modules through thorough redesigning and re-evaluation of the module's overall design. HedraPod 03 is a single octagonal polyhedron module containing all the necessary functions and storage required for an urban minimal dwelling. The module can house a maximum of two inhabitants in its non-expanded state and is able to fit a maximum of six to seven people when fully expanded. The interior is divided into two main spaces: the living area and the wet area. The living area contains a lounge sofa that transforms into a double bed, a table and bench seats that slide out from the live-hinged walls, storage spaces for the inhabitants' personal belongings, a washing machine and dryer facing opposite the storage space for easier access, and walls made of foldable OLED screens to provide the inhabitant a view of the outside as well as for entertainment and work purposes (LG Nordic, 2015). The separating wall between the living area and the wet area is also made of foldable OLED screens, serving as a pseudo window for the dwelling. The wet area consists of a latrine with sink on top of the flush water cistern, a shower in the middle of the space, a storage space for items required in wet areas, and a minimal kitchenette containing a water dispenser, a small refrigerator, a microwave, cupboards, cabinets, a recycling station and a waste disposal station. The kitchenette is based in the potential lifestyle of future urban inhabitants and their consumeristic tendencies. Due to the future urban circumstances stated at the beginning of this thesis, the trend of home cooking in urban centres dwindles and more people would rather buy or order food from stores and restaurants. This leads to the change in the kitchen designs in the future, which prioritises ready to cook and reheating store-bought food instead. To access the functions inside the wet area, the inhabitant can simply push and pull them when requiring the usage and occupy the majority of the wet space; however, each function can only occupy the wet area one at a time; two functions cannot be used at the same time. The equilateral octagonal form allows for a comfortable yet minimal interior without hindering the functions when being used. Modular connections between similar modules are also possible; however, displacement between each module is required to prevent collisions during the expansion process.

Figure 89. An isometric view of HedraPod 03.

Figure 90. A long perspective section of HedraPod 03.





Figures 91. Section drawings of HedraPod 03.

Figures 92. Plan drawing of HedraPod 03.



HedraPod 03 offers an improved design of HedraPod 02 after re-evaluating the positive and negative aspects of the previous modules. The module addresses all the necessary requirements for an urban minimal dwelling as well as the thesis's aims and objectives; however, the design itself needs optimisation. The module, no matter how much smaller it is compared to HedraPod 02, still remains a little large compared to conventional urban minimal dwellings. Granted, the space is capable of containing all the necessary functions and provides sufficient amounts of storage spaces; however, there are still several dead zones within the design that need re-purposing and filling. Some of the emergent technology used in the design proved to be helpful; however, there is no need to overtly fill the dwelling with technology for the purpose of having technology. The use of technology present in the design needs revising and using only when necessary. The modular connectivity of the module is not as straightforward compared to the previous modules and design iterations; thus using an octagonal form as the external form requires re-assessment.

Figure 93. An isometric view of HedraPod 03.

Figure 94. A long perspective section of HedraPod 03.

Overall, HedraPod 03 is the most successful developed design out of the three HedraPods and making it the most viable lead-up for the final design for the proposed alternative to future urban minimal dwelling, HedraPod 04.



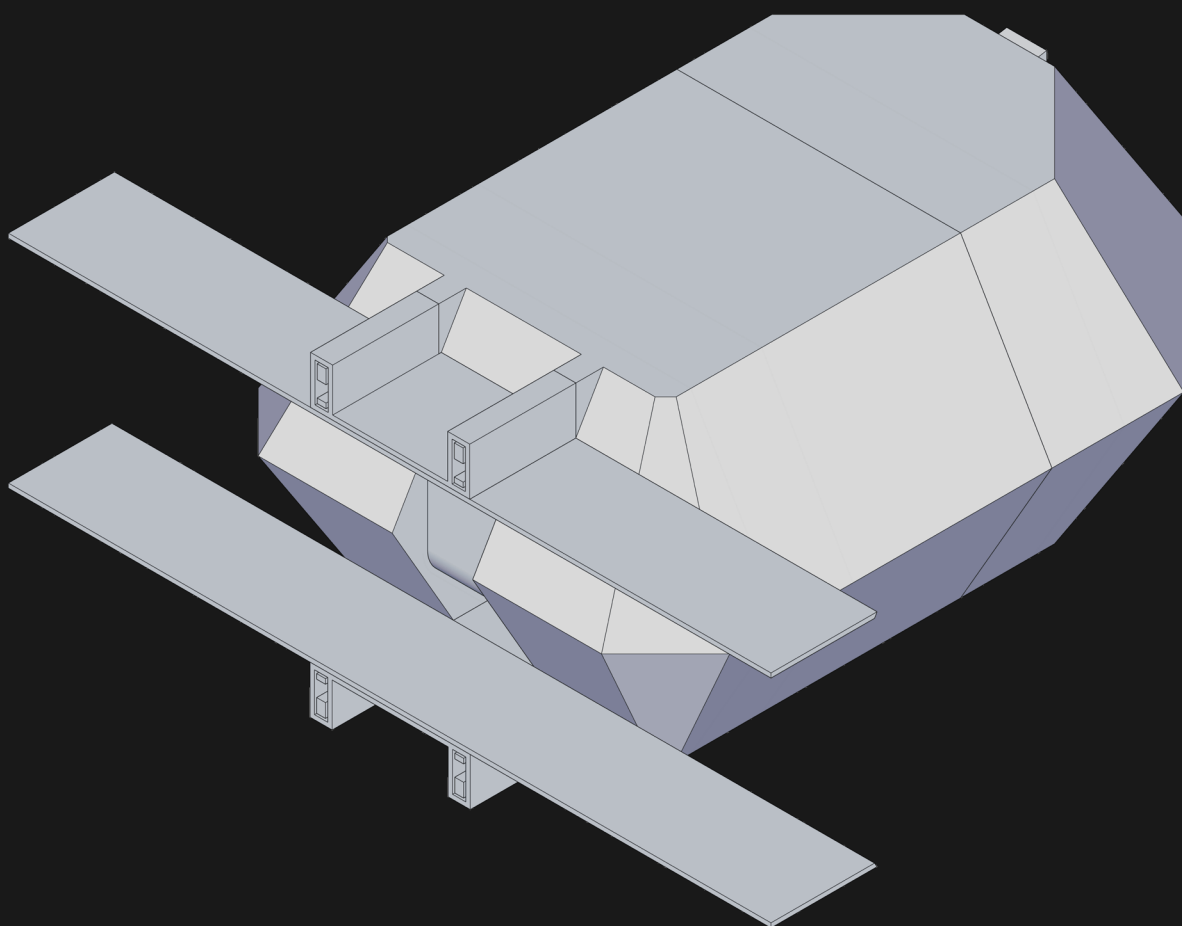
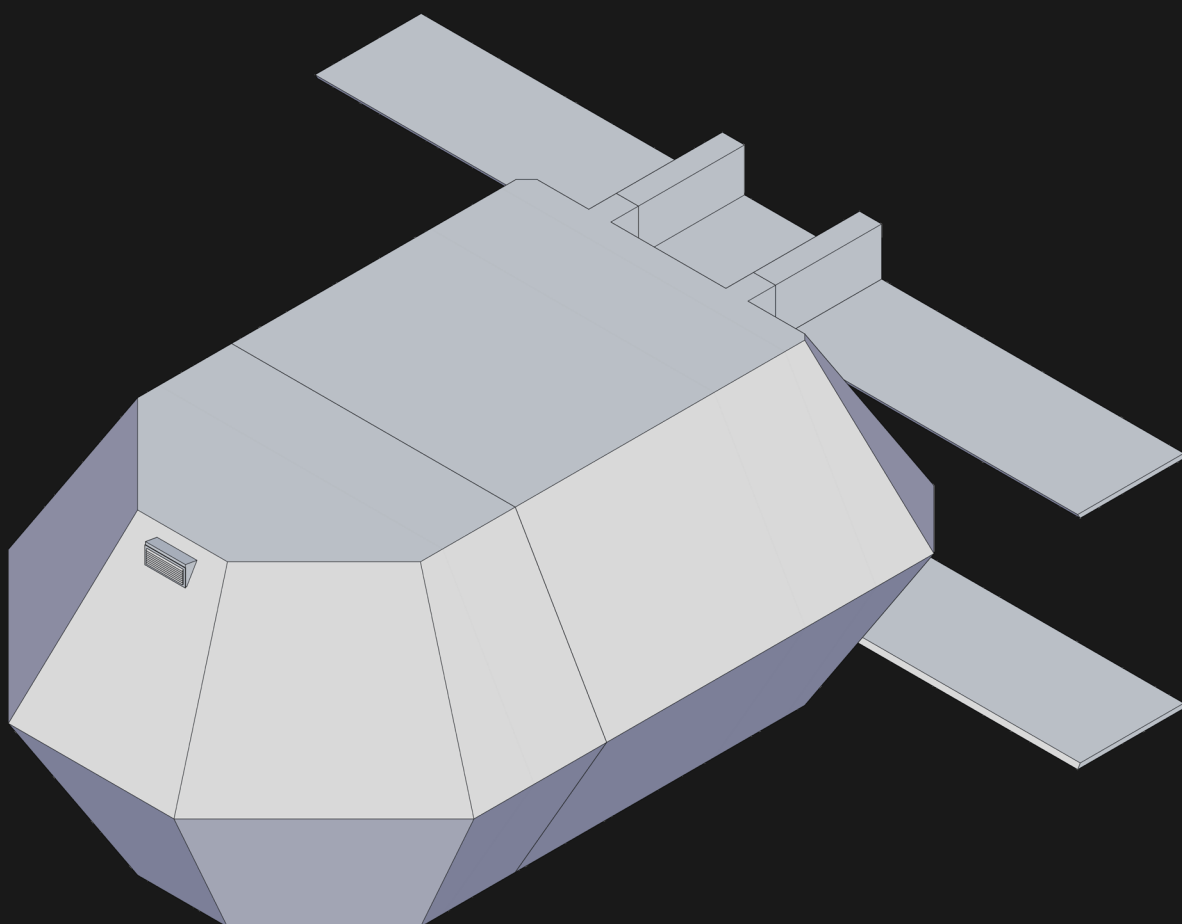


## 6.4 HEDRAPOD 04

The design study develops one more instalment in further detail, HedraPod 04. The module has a hexagon-based polyhedral form for its exterior. This form allows for an even modular connectivity along other modules of the same form as well as a smoother expansion process. The module connects to a support structure from the entrance end through using the water distribution and waste drain pipes with locking mechanisms. Like its predecessors, the modules are capable of expanding its longitudinal length by 2m beyond its original length. The expansion is only necessary if the inhabitants wish to accommodate more than two persons at the same time.

Ideally, HedraPod 04 is designed with prefabrication and pre-assembly as the construction method in mind. The viable materials for the module's frame structure can be anything as long as they are lightweight, durable, easily obtainable, structurally stable and weatherproof. As for the exterior cladding, the material must be weatherproof, lightweight, durable and easily obtainable. The most viable materials for the frame structure are wood, aluminium and carbon composite, while the viable exterior cladding materials are stainless steel, carbon composite and expanded polystyrene.

The module's interior is an octagonal-based polyhedron for an ergonomic and healthy space. It is divided into two areas: the wet area and the main area. The main area serves as the public and private space of the module, mainly containing the entrance, lounge room, bedroom and storage spaces. The wet area contains all the functions subject to high levels of moisture, mainly the kitchenette, toilet, laundry space and shower. The interior is physically divided into three segments: the entrance end cap, the main area shaft, and the wet area end cap.



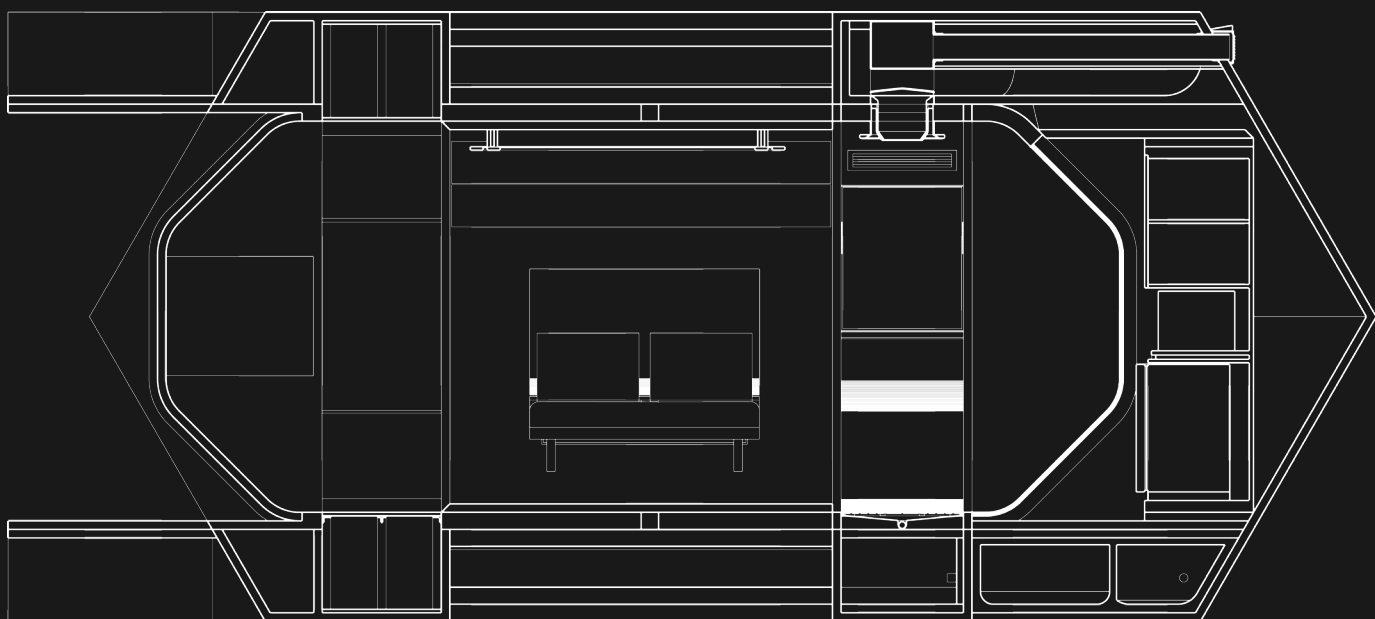
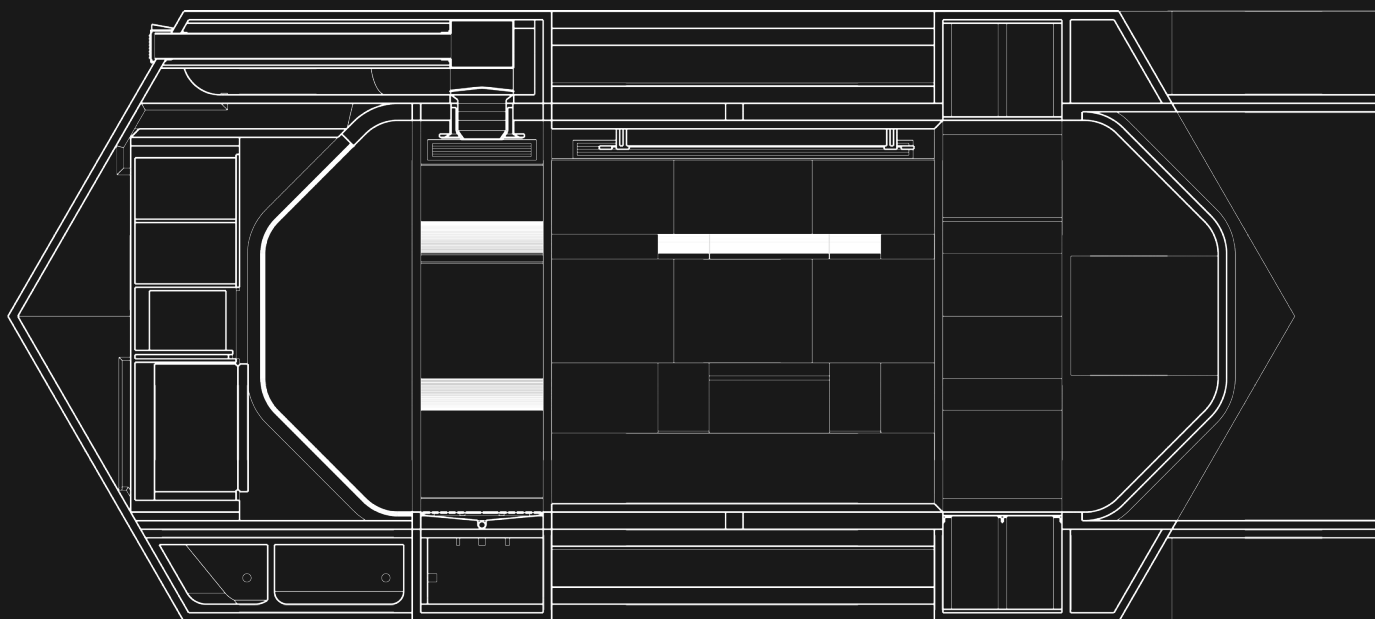
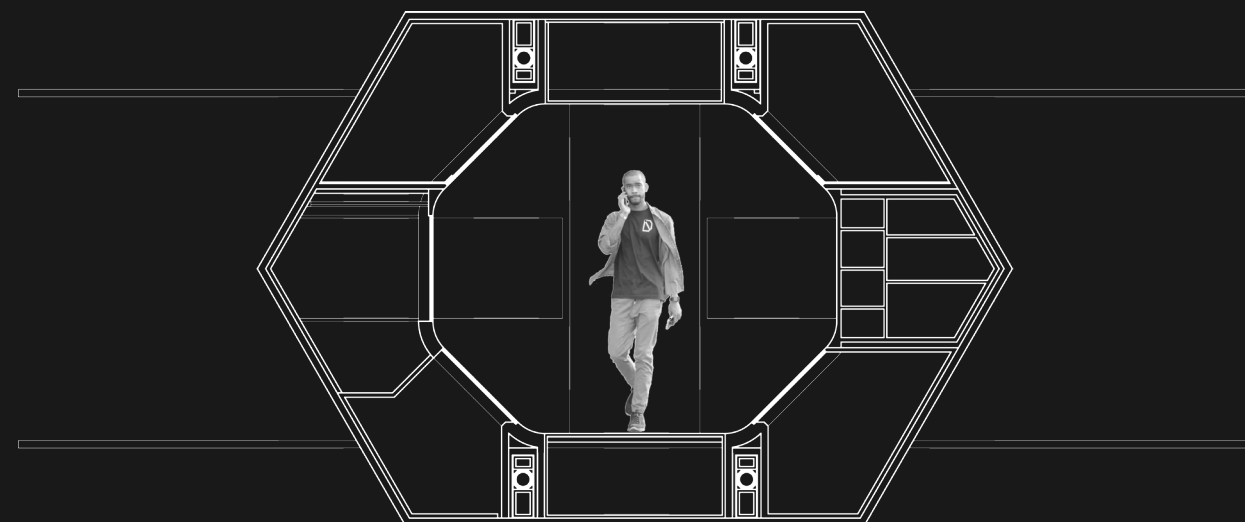


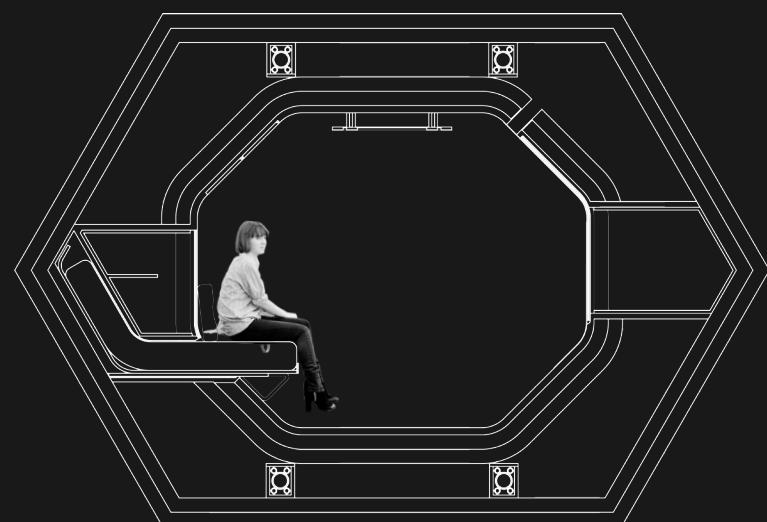
Figure 95. Isometric drawings of HedraPod 04 in its base form.

Figure 96. Long section drawings of HedraPod 04 in its base form.

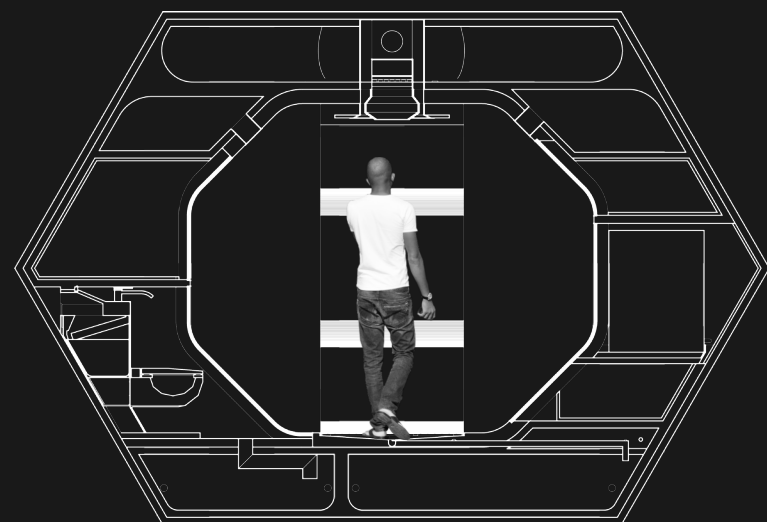




Entrance and Storage



Main Area



Wet Area

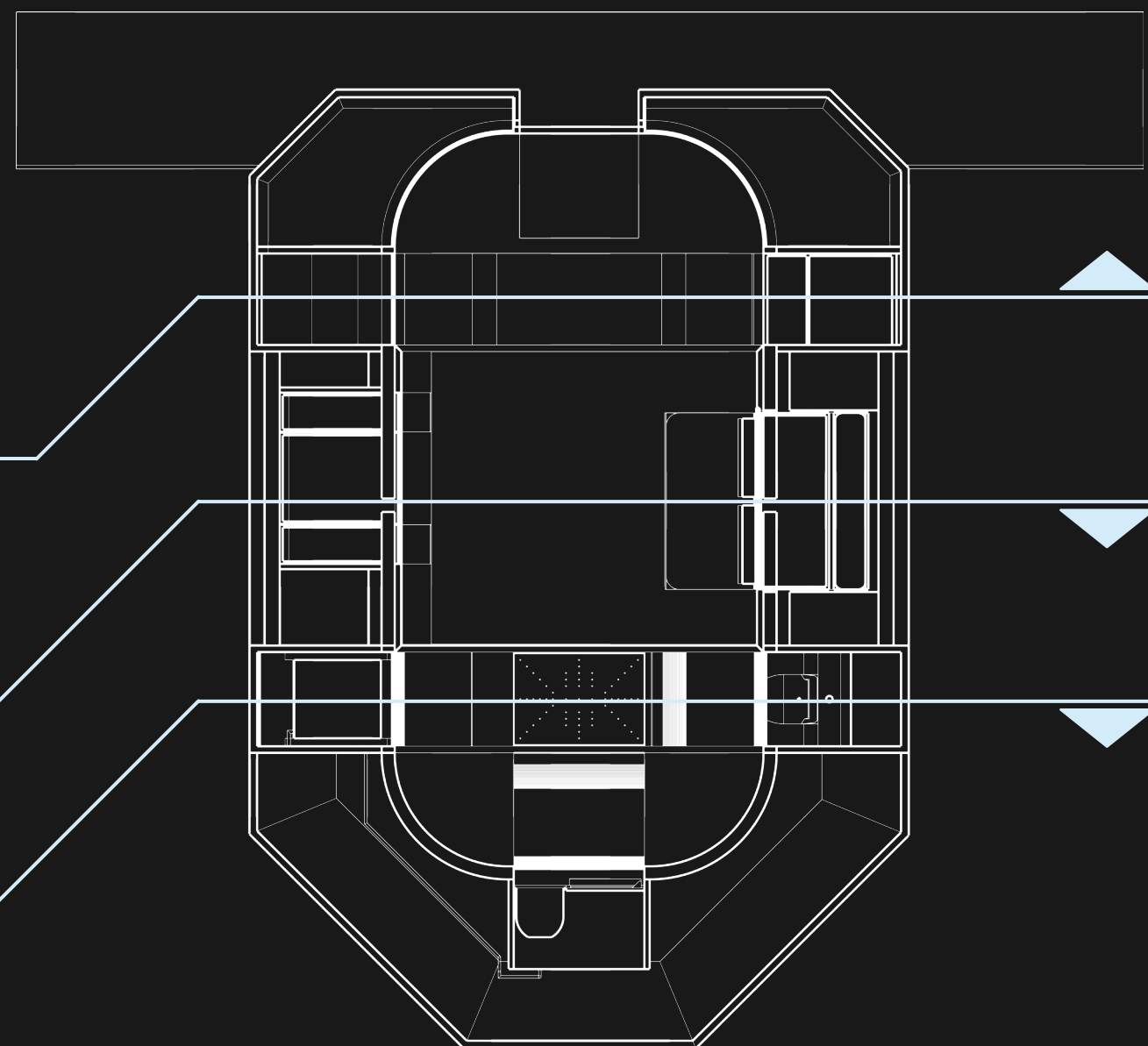
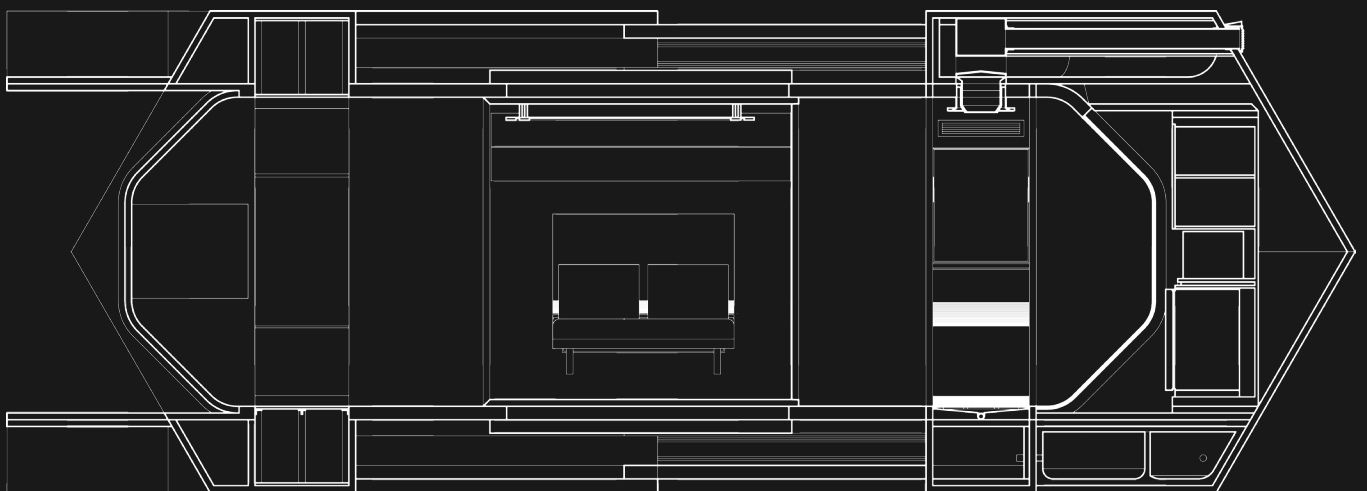
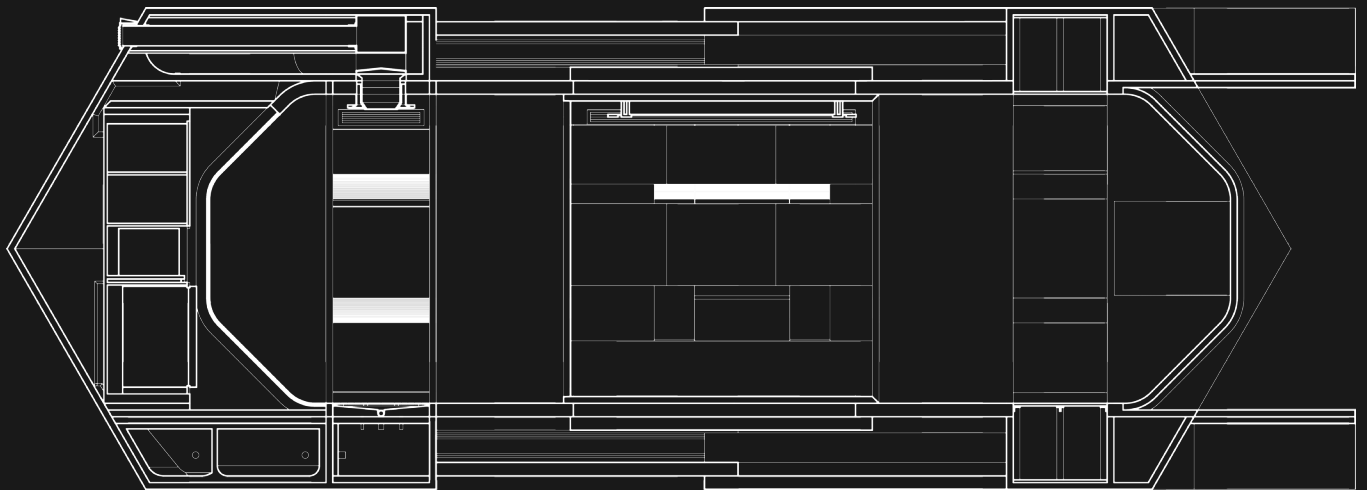
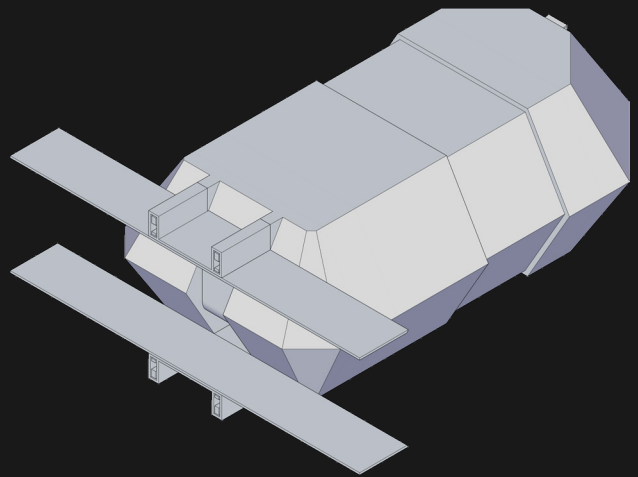
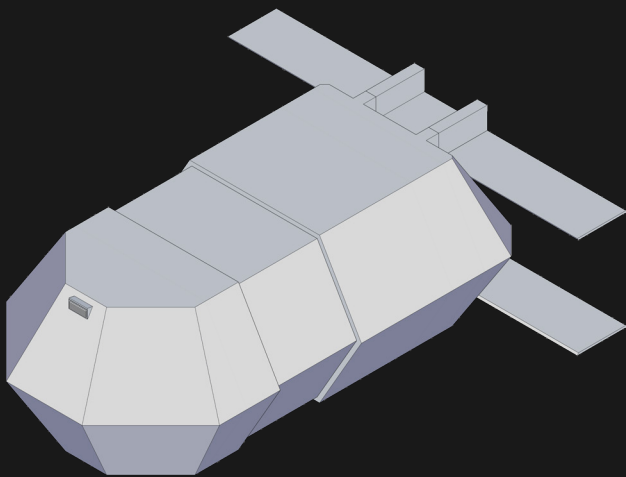


Figure 97. Cross section drawings of HedraPod 04 in its base form.

Figure 98. Plan drawing of HedraPod 04 in its base form.





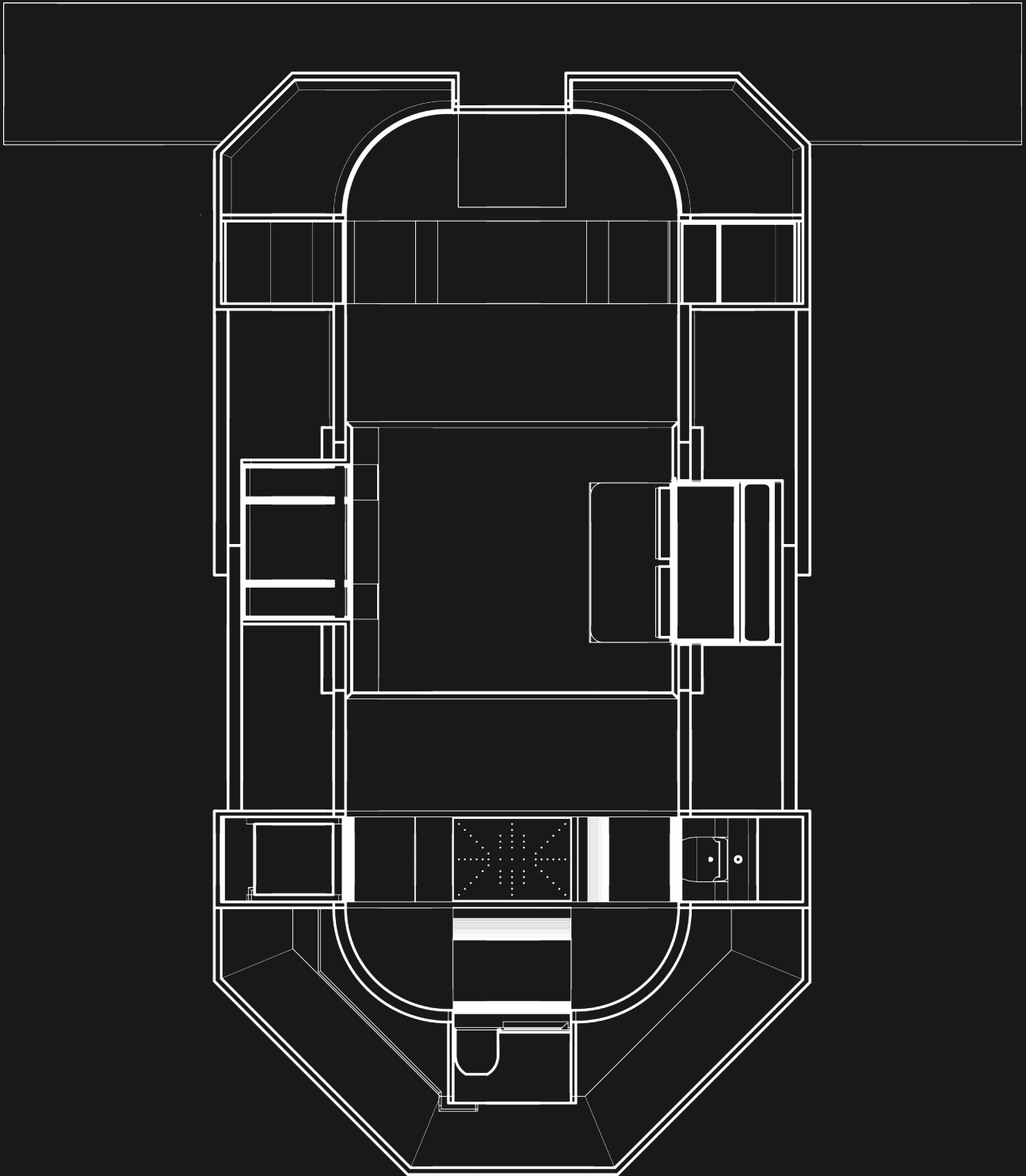
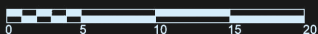


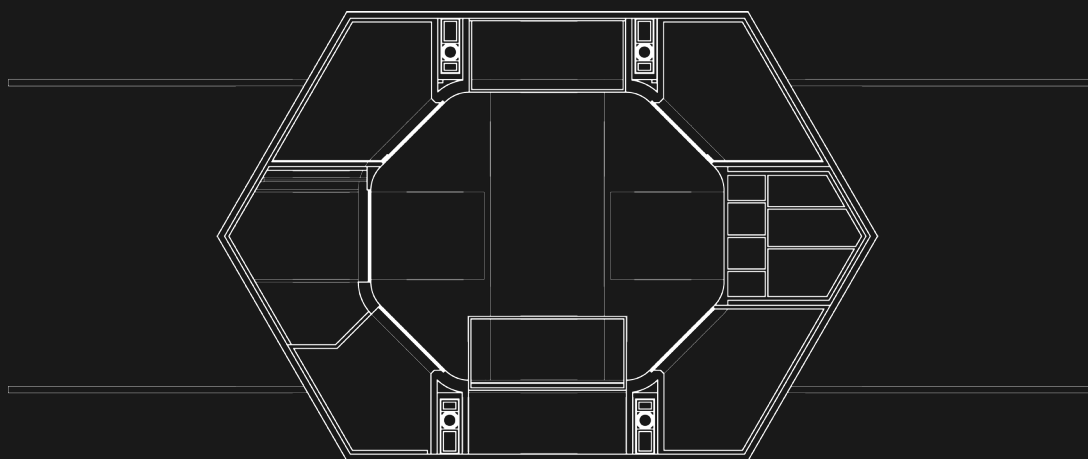
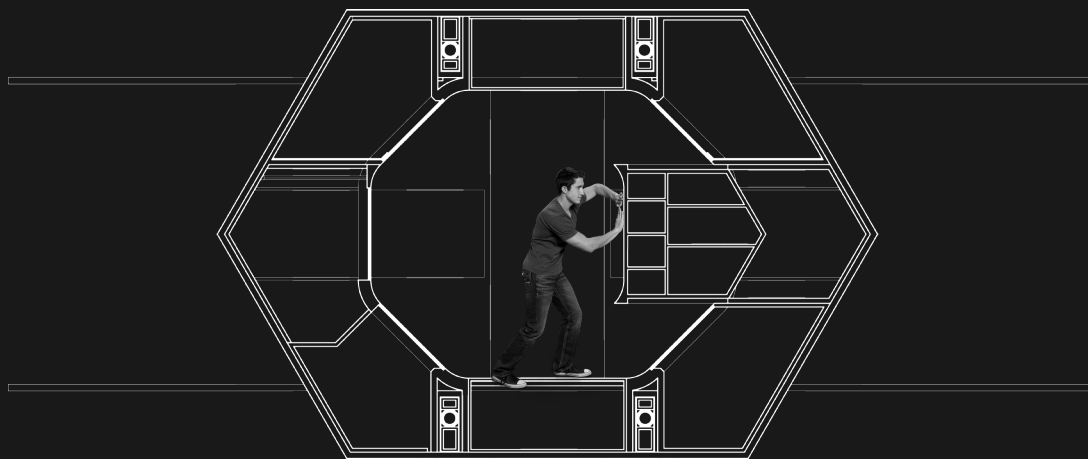
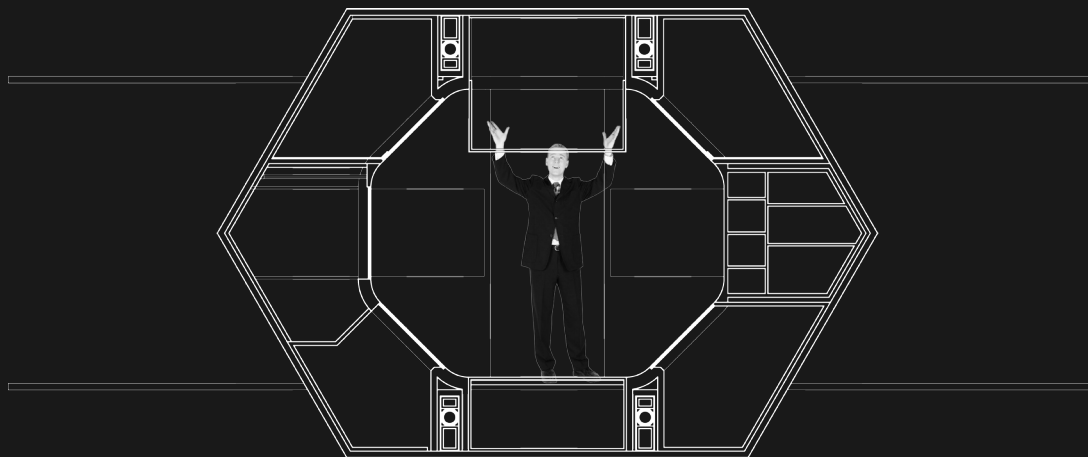
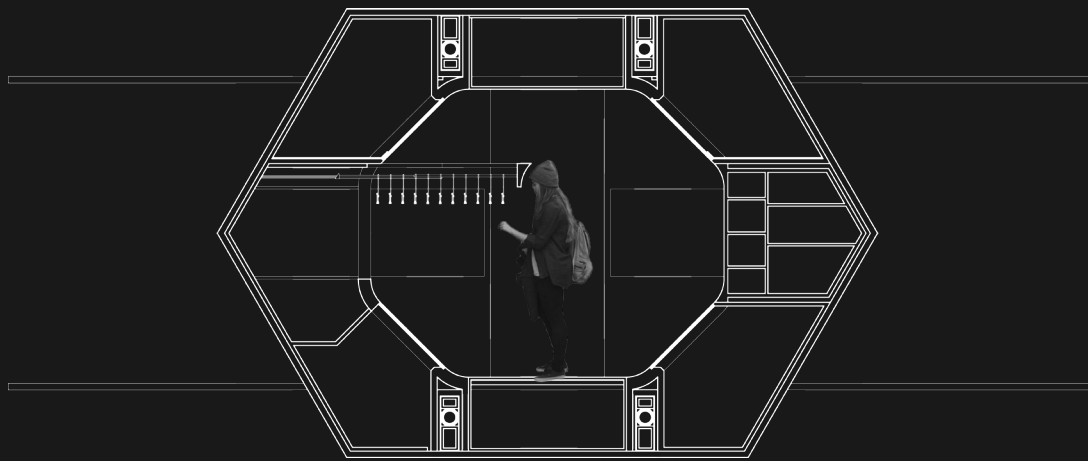
Figure 99. Isometric drawings of HedraPod 04 in its expanded form.

Figure 100. Long section drawings of HedraPod 04 in its expanded form.

Figure 101. Plan drawing of HedraPod 04 in its expanded form.







## Entrance and Storage

The entrance door uses living hinge technology to open and close. Including the retracting hanger rack and sliding clothing cabinet, there is a total of eight storage spaces around the entrance. The side storage spaces area is accessible through sliding living hinge walls, while the overhead and underfloor storage spaces slide down and up respectively. There are multiple viable materials used for the interior cladding since the requirements need to be lightweight, durable, non-flammable, water-resistant and structurally stable. For convenience, the viable materials are narrowed down to natural or man-made wood and carbon composite. Kydex is a type of thermoplastic often used as aircraft interior linings ("KYDEX® Thermoplastic Sheet | Easy to Form Material," n.d.), making it an excellent material for the majority of the module's internal lining, including the inner door and wall material for the living hinges.

The storage spaces are placed close to the entrance for several valid reasons. Out of all the functions in a living space, the entrance is the least used since inhabitants only access it when they enter or exit the dwelling. The immediate space surrounding the entrance can be considered as a dead zone since barely any activities happen around them. By situating the storage spaces there, the dead zone is then consumed by a function commonly accessed by the user and allows for better circulation within the interior space. Having the storage spaces around the entrance is also convenient for the inhabitant since it does not hinder any other space within the module as well as allows them easy access to their belongings whenever they are in a hurry to enter or leave the dwelling.

Figure 102. Cross section drawings of the entrance and storage area in four phases: the hanger rack (top), the overhead storage (upper-middle), the wardrobe (lower-middle), and the underfloor storage (bottom) phases.

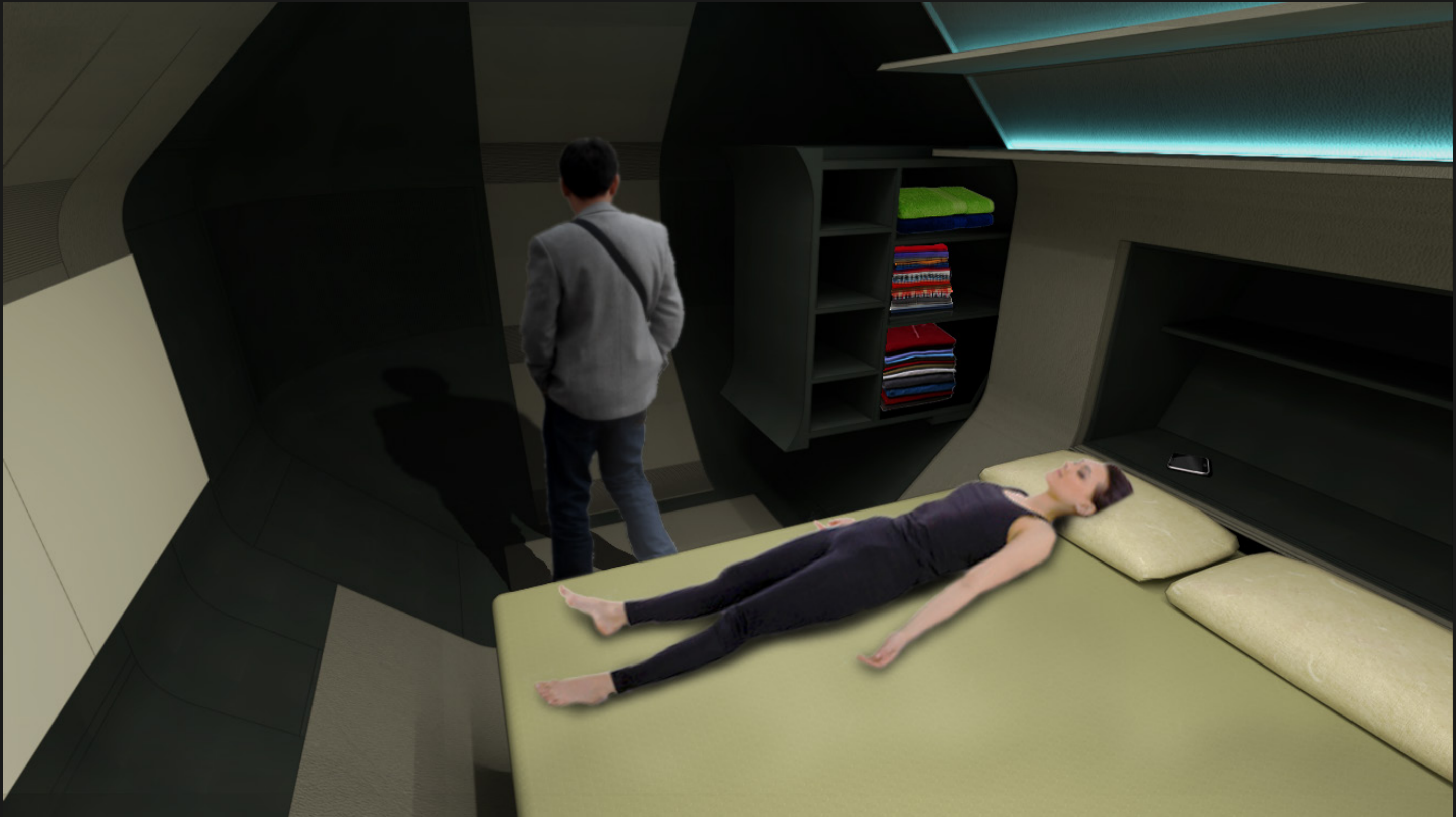
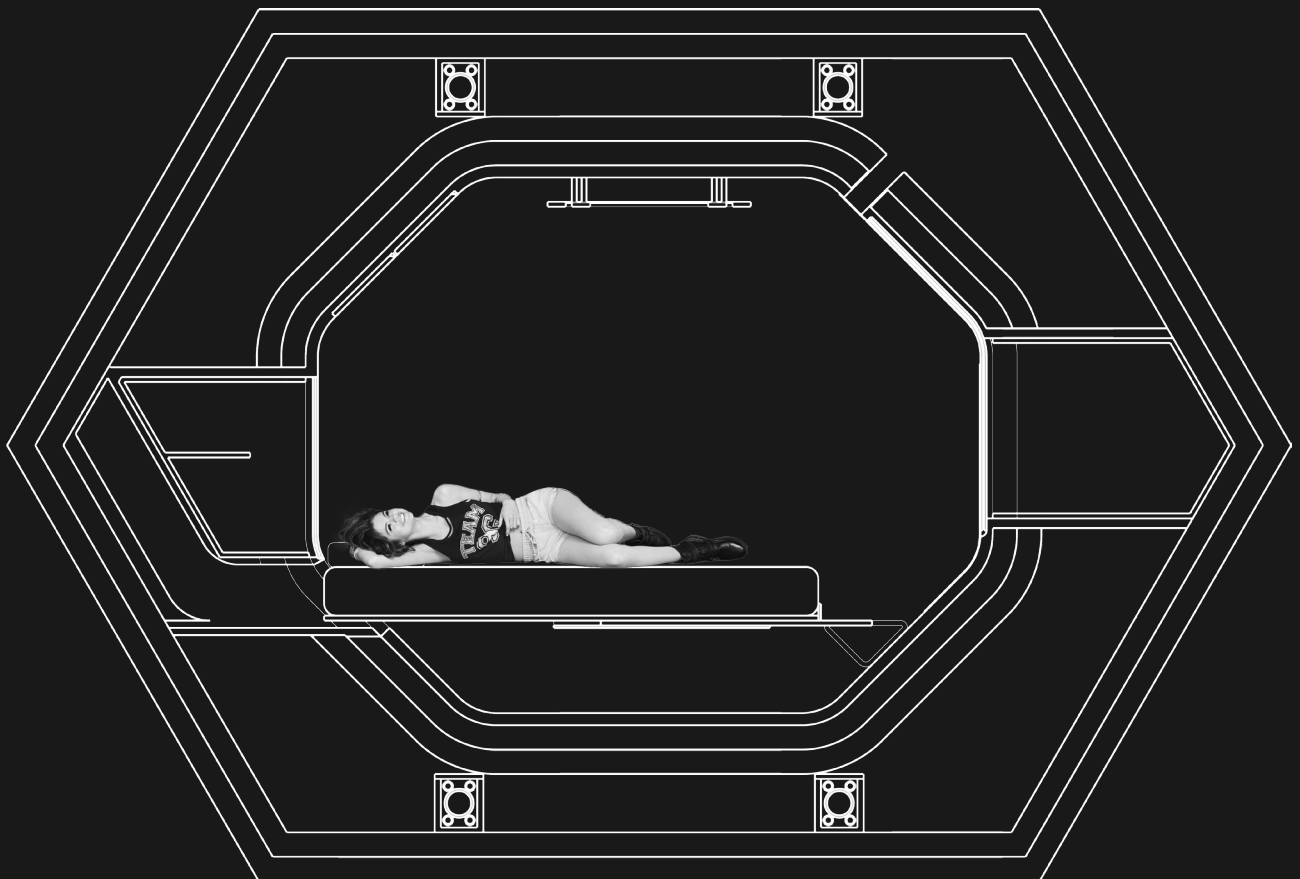
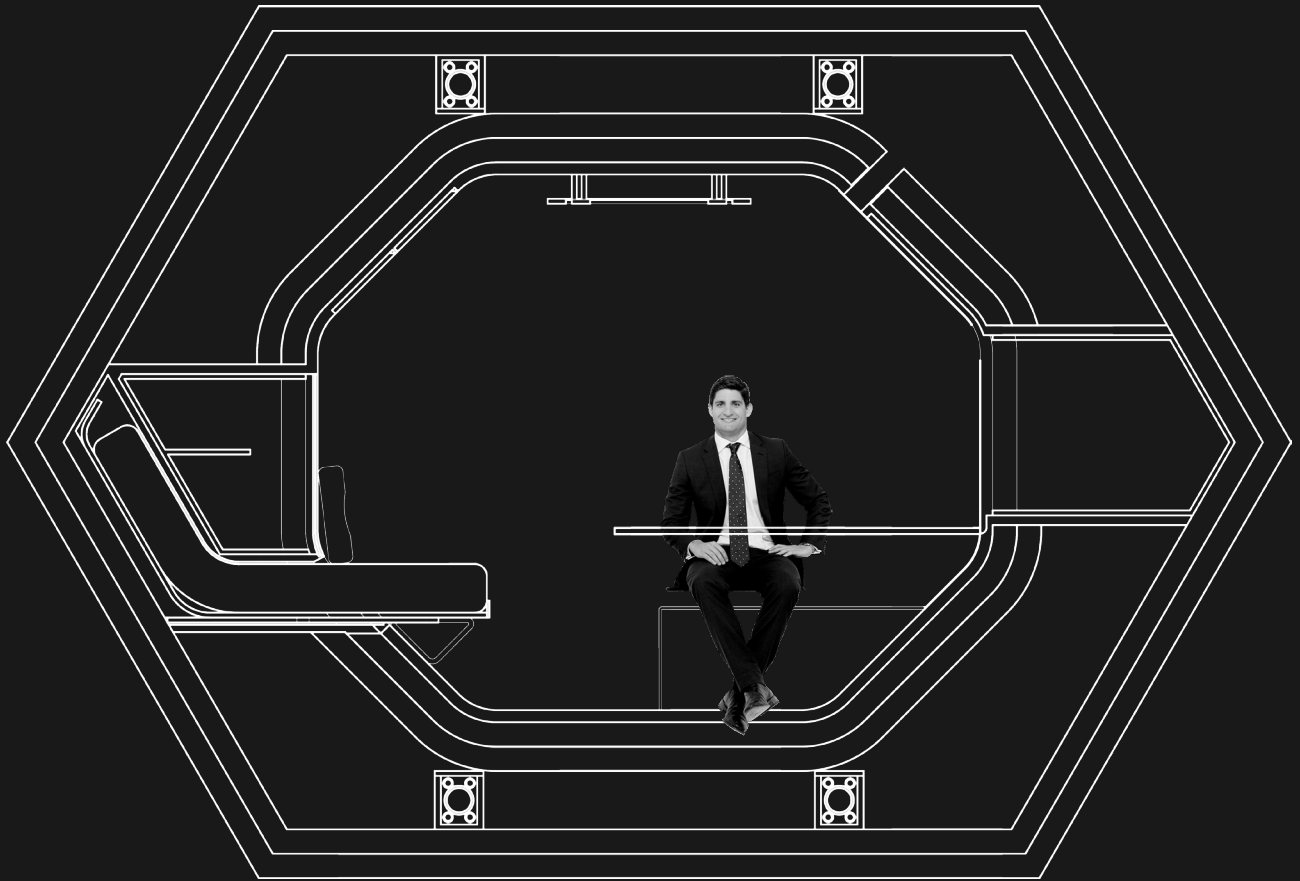


Figure 103. HedraPod 04 in its bed and wardrobe phases.



## Main Area

The main space of the module contains necessary functions such as a bed area, a dining area, a work area, and a lounge area. These functions interchange with each other depending on the inhabitant's need to access these functions. The lounge transforms into the bed by fully sliding out the mattress to the opposite wall. The wall containing the lounge bed slides up to reveal a compartment for the inhabitant to place items easily accessible when they lie on the bed. It also has folding overhead shelves, allowing the inhabitants to customise the space. The wall across the lounge bed has OLED screens on its surface as well as living hinge wall surfaces that slide out into benches and a table for the inhabitant to dine on. The table and bench surfaces, also made of Kydex, sandwich a thin film that, when vacuumed, becomes a working surface. When the screens, table and benches all slide out, they reveal a storage space that slides out from the wall. A dropped ceiling LED light box illuminates the entire main space along with directional strips of LED lights to provide the necessary artificial light and ambience within the space. In order to separate the main area from the wet area without using a thick and rigid internal wall and door, a large foldable OLED screen (LG Nordic, 2015) is used instead as the folding door.

Having the interchangeable functions in the main space allows for more movement and working space for the inhabitant when each function is being used, or when no function is being used at all. This also clears out any potential circulation obstructions leading to both the entrance and the wet area, fully maximising the minimal space.

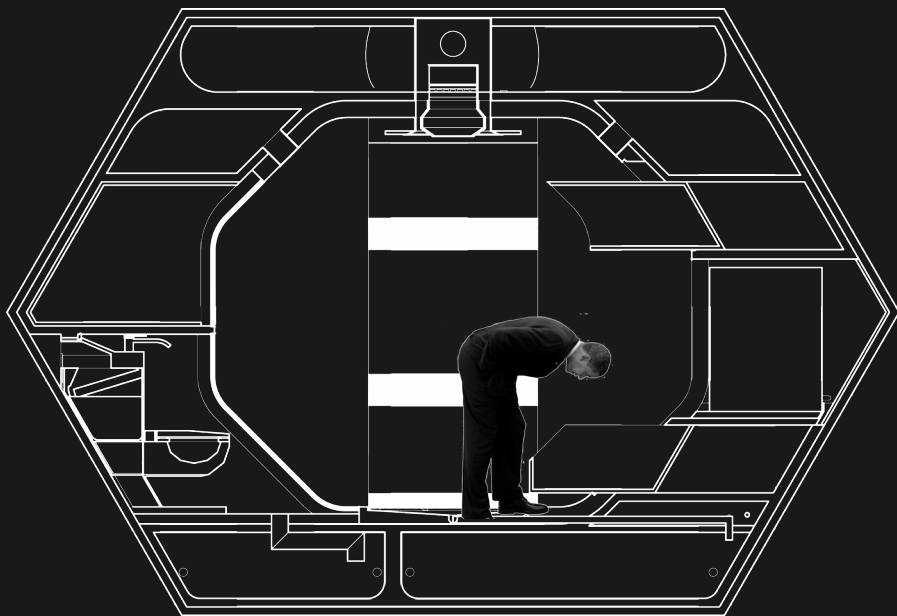
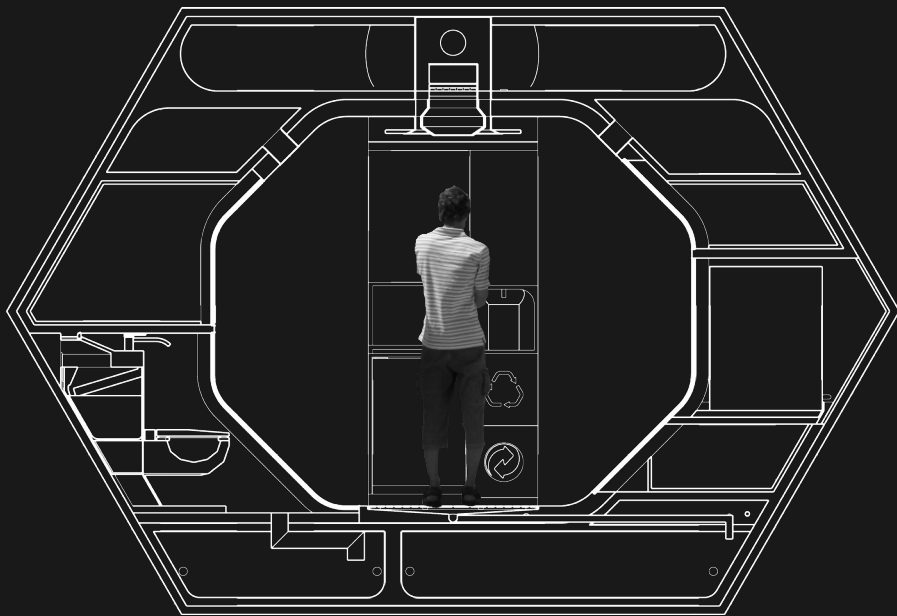
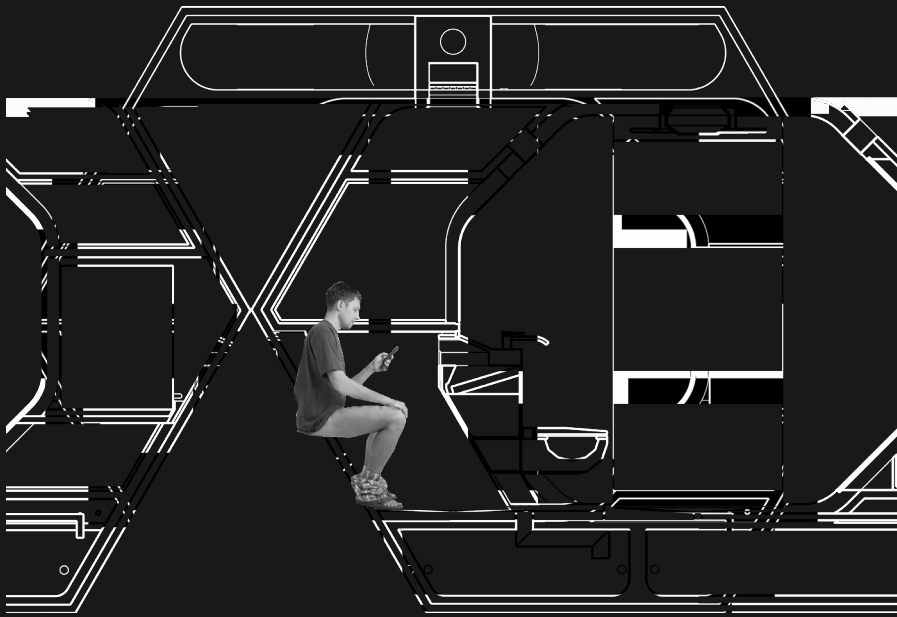
Figure 104. Cross section drawings of the main area in two phases: the dining and tabletop (top), and the bedroom (bottom) phases.





Figure 105. HedraPod 04 in its lounge phase.





## Wet Area

The wet area of the module contains a shower room as its base form, a sliding toilet with a sink, a sliding kitchenette, a sliding laundry space, and a sliding storage space for cleaning products, toiletries and other wet area related products. Underneath the floor of the wet area are membrane bioreactors (Judd Water and Wastewater Consultants, 2018; Tian et al., 2008) built separately for grey water and black water within to convert biowaste into filtered water for drinking, showering and other functions within the space. The two bioreactors are also connected to a mainline waste drainage pipe to prevent any overflow and maintain a healthy and clean wet area. Above the ceiling is a water tank connected to a mainline water supply pipe that distributes water among each function in proportion to their expected water consumption. A ventilation system is also implemented along the dropped ceiling light box in the wet area to manage excess moisture within the space.

The wall mounted toilet slides in and out once the live hinge wall is slid up. The sink attached on the toilet's cistern can expand in size when the inhabitant requires more sink space. Above the toilet is a storage space hidden behind a malleable mirror surface for toiletries, cleaning products, and other wet area related products. It can be accessed by sliding the live hinge walls up. Directly across the toilet and storage space is the laundry area. The two-in-one laundry and dryer machine slide out of the wall when the live hinge wall is slid up. Above the machine is a sliding storage space for clean towels used after showering and/or wiping wet surfaces, and below the machine is a laundry hamper for dirty clothes that need to be laundered. The kitchenette slides out from the end cap of the wet area after the live hinge wall slides down. It contains a microwave oven, a refrigerator, cupboards and pantry, a water dispenser connected to the bioreactor filtered water tank and the overhead water tank, a biodegradable waste bin and a recyclable bin. The kitchenette has no cooking element and sink since the design expects the inhabitants to not have enough time to cook before going and arriving from work. The inhabitant would rather buy cooked or pre-made food from stores and markets instead of cooking (Maggie, 2016).

Figure 106. Cross section drawings of the main area in three phases: the toilet (top), the kitchen (middle), and the laundry (bottom) phases.

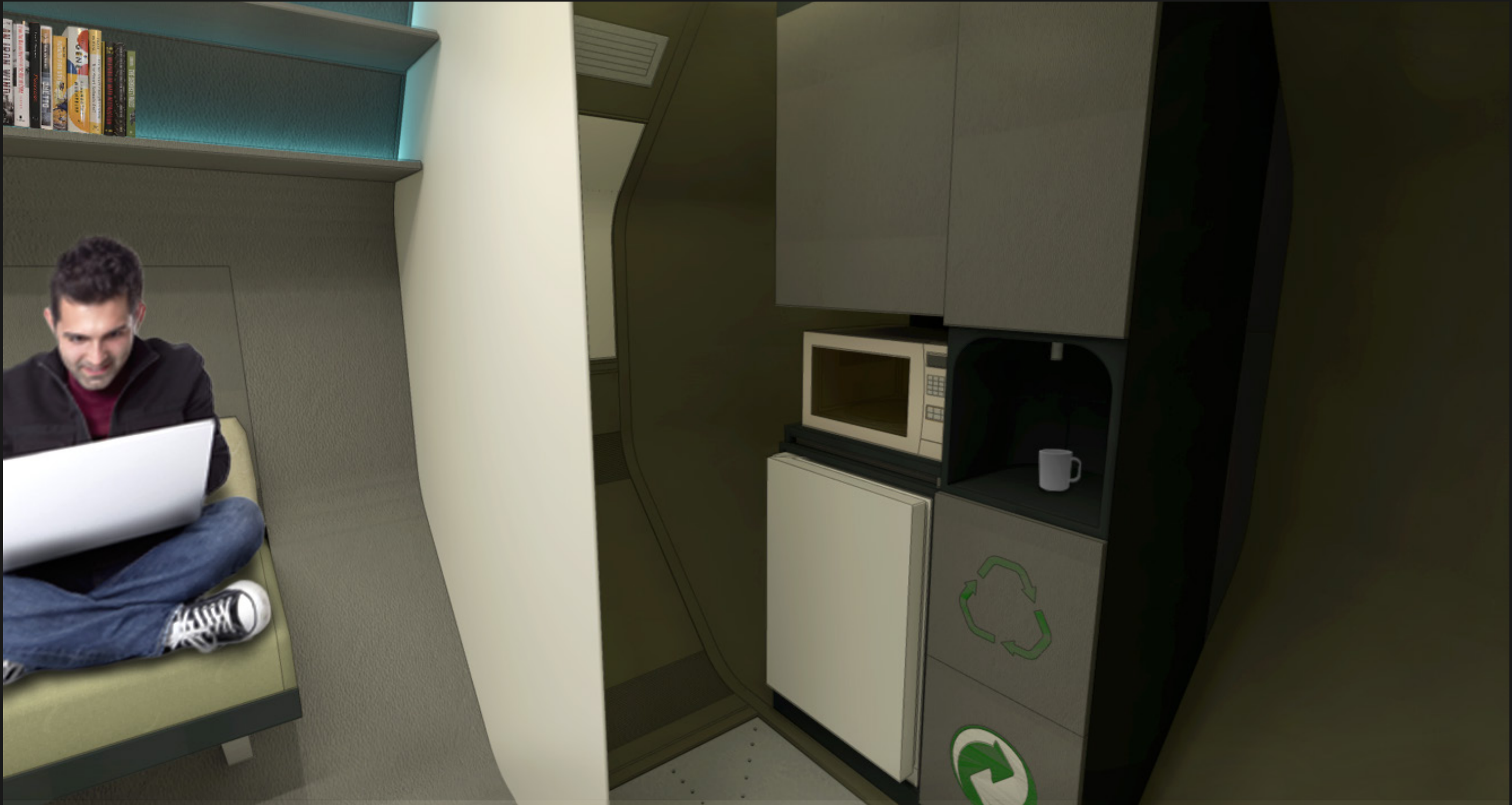
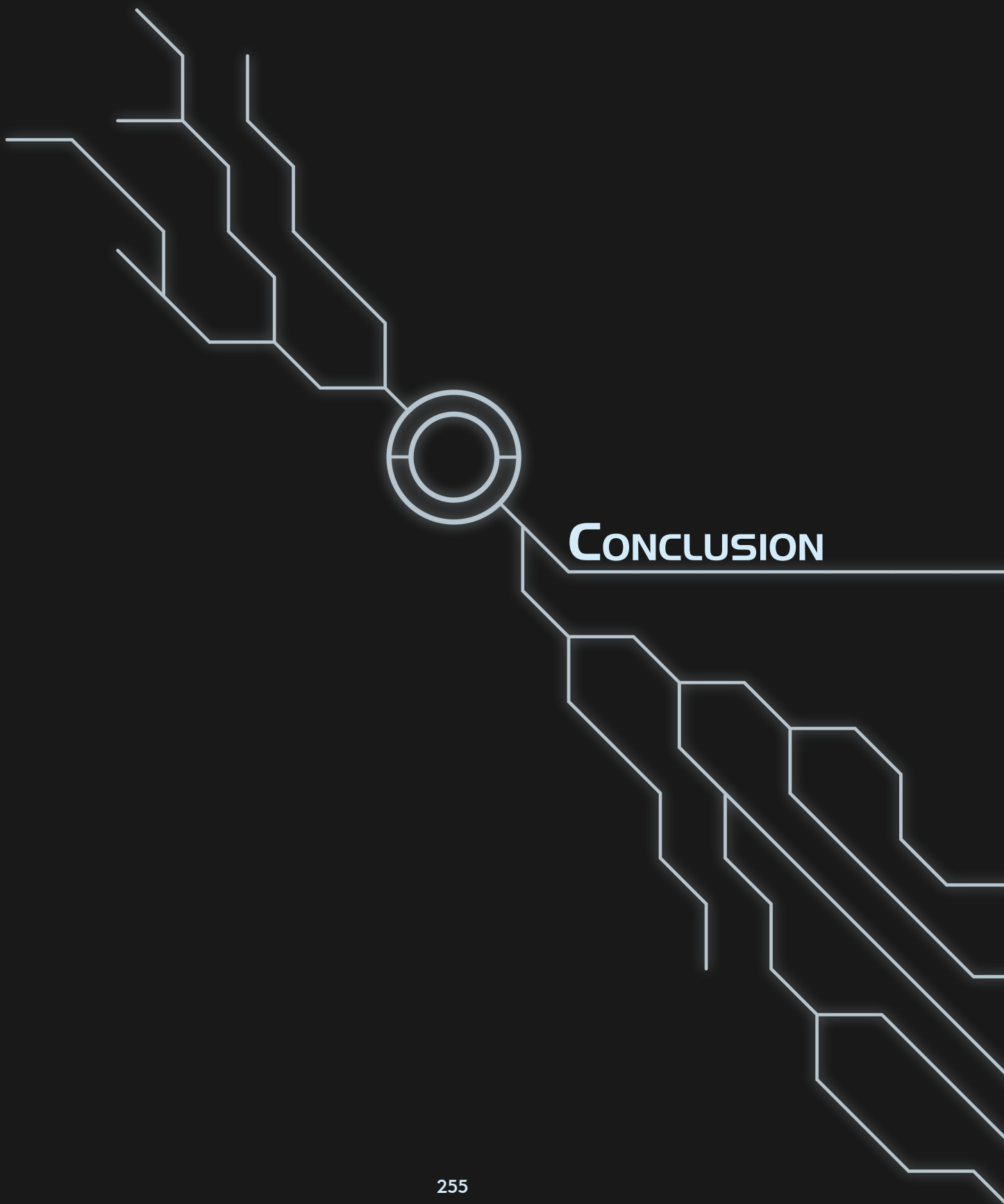


Figure 107. HedraPod 04 in its lounge and kitchen phases.









Producing an urban minimal dwelling for a future urban setting with emergent technology propelling the design requires a lot of research, experimentation and iterative designs, especially since most information regarding emergent technology is difficult to come by. Scouring for the correct and accurate information resulted in me spending more time in researching than necessarily needed. Another factor that made the design development arduous was the individual perception of a minimal dwelling. Although texts such as Neufert's *Architects' Data* alleviated some of the problematic design elements for the HedraPods, the fact that each individual has a unique perspective about the world meant minimal space would vary from person to person. Designing a new conventional format for an urban minimal dwelling requires standardising the overall module dimensions, which may result in less comfort for people who are tall or large in stature.

The overall outcome of the design is interpreted as a statement enabling the possibility for a person to live within a minimal dwelling that contains all the necessary functions and storage, and that provides a comfortable and salubrious space using emergent technologies as tools and vessels for the inhabitant. I was also able to determine a potential method for designing and developing minimal space by using the human's maxi-minimal reaching span to determine the absolute size limit of a minimal dwelling. This method not only allows unhindered movement within the space, but also permits ergonomic postures for most actions. I consider this design as an overall success.



The amount of the research undertaken for this thesis speaks volumes about potential ways to improve the outcome of this thesis. One of the potential aspects that could have been explored was the support structure holding the modules. Although the locking mechanisms and connectors for the HedraPod and the plumbing pipes were all included in the design, it would have been great if the structure were developed along the way. It would have been a challenge for me as an interior architecture student since my current knowledge regarding structures is limited to what was offered in the interior principles, although I do express an interest in developing structures for projects similar to this one in the future. Another potential improvement would be further refinement of the interior space of the HedraPod. The design does execute its purpose quite well, but improving the overall aesthetic, material choices and function layout would not be detrimental to the outcome.

I hope whoever reads this thesis finds it useful and helpful in regards to its research scope. I produced this work with the intention to contribute to solving the elusive minimal dwelling, or at the very least, provide snippets of information leading to a solution to this dilemma.

Accumulating all of the knowledge, skill and determination along the entire process of beginning, developing and concluding this thesis, I intend to embark on an even more daunting endeavour: finding a career opportunity in designing and developing interior architecture, hopefully within the field of my thesis topic. Thank you very much for reading my thesis.









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