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ATLANTIS

THE FIRST LIGHT



Previos page_Figure 2_ Aatlantis - The First Light cover. Peters, M. (2022).



The background of the entire page is a light gray topographic map. It features contour lines that define various landforms, including a large mountain range on the left side and a smaller, more isolated peak at the top center. The map is rendered in a minimalist, line-art style.

ATLANTIS

THE FIRST LIGHT

NATURE-INSPIRED DESIGN FOR CITY BUILDING IN VIRTUAL REALITY

An exegesis presented in partial fulfillment of the requirements for the degree of

MASTER OF DESIGN

at Weta Workshop's School at Massey University, Wellington, New Zealand.

MONA PETERS

2022



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The background of the page features a light gray topographic map. The map shows various landmasses and water bodies with contour lines. A prominent landmass is visible on the left side, and another is at the top center. The map is oriented with North at the top.

> ACKNOWLEDGEMENTS

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> GLOSSARY OF KEY TERMS

Biomimicry	The emulation of life's (and nature's) engineering
Biophilia	Humans' connection with nature "biophilic design is replicating experiences of nature in design to reinforce that connection." (Bernett, 2017, p.1)
Salutogenesis	An approach to wellness, focusing on health rather than disease (pathogenesis) (Gómez, n.d.)
Speculative fiction	A category of fiction that includes genres with elements that do not exist in reality, such as science fiction and fantasy (Speculative Fiction, n.d.)
Twin Motion	3d creation tool for photoreal visuals and immersive experiences developed by Epic Games
Virtual Reality (VR)	A simulated immersive 360 degree experiences that can be experienced through wearing a headset

The background of the slide features a light gray topographic map with contour lines, primarily visible on the left side and extending towards the center.

> ABSTRACT

In the past century, some architectural movements like Modernism and Brutalism have caused unfavourable psychological effects for inhabitants. However, contemporary studies suggest that nature-inspired design and unconventional urban planning can create living environments that have a positive impact on the well-being and productivity of their users.

Using an original narrative inspired by Plato's Atlantis, this project develops a six minute proof of concept animation for a speculative fiction Virtual Reality experience, which mixes cinematic entertainment with education tools to "edutain" late teens and young adults about biophilic design, leading-edge fabrication methods and urban planning.

Cities around the world are rapidly growing, with the UN Population Reference Bureau predicting an increase of up to three billion in the urban population by 2050 (PRU, 2007).

New digital fabrication methods and scientific research into the psychological impact of architecture offer a range of new solutions to create more beneficial human habitats, however progress is slow. This project proposes education through awe-inspiring entertainment as a way to help mitigate this fact and aims to resolve the question:

HOW CAN WE AS CONCEPT DESIGNERS HELP BROADEN AN AUDIENCE'S PERSPECTIVE ON NATURE-INSPIRED ARCHITECTURE AND URBAN DESIGN?

Drawing from research in the fields of psychogeography, biophilia and biomimicry as well as the concepts of Utopia and Dystopia, and also the potential of awe-inspiring cinematics for edutainment, the project employs a variation of the design thinking methodology that offers an organic problem solving strategy to help answer this question.

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> 1. NARRATIVE SYNOPSIS



"It is the year 2150,

*It has been 100 years since a cataclysmic event forced humanity
to leave planet earth and retreat into outer orbit..*

Living aboard space stations, a new generation was born...

but what remained - was the longing for home.

And as time passed, a new movement grew,

a movement preparing for the return to earth.

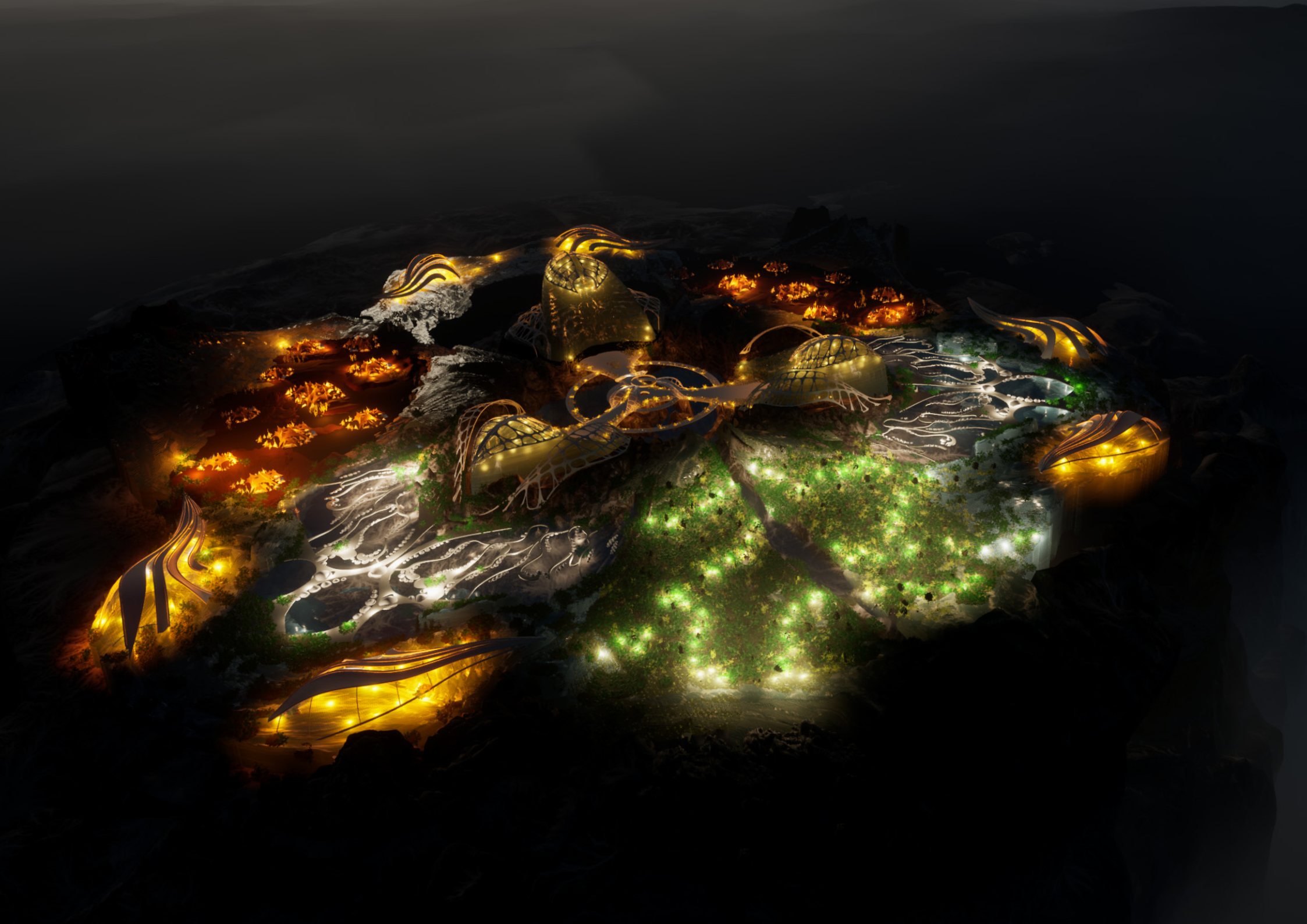
Drawing wisdom from history and inspiration from nature,

the blueprint for the first new city was born..."





*“...a city, designed following the principles of nature and made reality
through the wonders of our 3d drone technology.”*



Previous pages:

Figure 3_ P. 13 The final Atlantis city design appearing in mist. Peters, M. (2022).

Figure 4_ P. 15 The final Atlantis city design close up. Peters, M. (2022).





Figure 5_ Antonio Gaudi's La Sagrada Familia, start of construction 1883. Rosenshein, R. (2016)

> 2. INTRODUCTION

The images shown on the previous pages are screenshots of the video proof of concept for the virtual reality (VR) experience “Atlaantis - The First Light”, which uses entertainment and cinematic tools to educate (edutain) the user about architecture inspired by biomimicry and biophilic design, leading-edge fabrication methods and sustainable urban planning.

> 2.1 BACKGROUND

At the age of 15, I was privileged to visit Antonio Gaudí's Sagrada Familia. Next to the overall extraordinary architecture, the aspect that left the biggest impression on me were Gaudí's models and studies focused on the application of nature's forms onto architecture, which would influence my later career as model maker and set builder in the film industry.

With millions of people world wide journeying to La Sagrada Familia each year (López, 2021), there is clearly an undeniable inclination within humans towards nature-inspired architecture. In fact, there are entire academic fields dedicated to the research of nature-influenced design, most notably the fields of biomimicry and biophilia.

> > 2.2 ABOUT THE PROJECT

At the core of the VR experience “Atlaantis - The First Light” stands the first new city on Earth that humanity is returning to after being forced to live in outer orbit for about a century, due to environmental collapse.

This project is a six minute long proof of concept video sequence, which shows a variety of features of the city, combining immersive video footage of the architecture and landscapes with educational infographics.

My roles on this project are that of the creative director and concept designer, writing the narrative and script, establishing the design language as well as designing, 3d modelling and animating the video proof of concept as a placeholder for a final VR experience that could be realised with a bigger team in the future.

The target group for the fictional VR experience are late teens to young adults with secondary education. This group will likely be able to retain information of medium complexity, has an existing knowledge base and arguably has the highest potential of creating innovation.

The final VR experience is aimed to be displayed in public places like museums and universities, potentially as part of exhibitions about architecture, VR and nature-inspired design.

As setting, the project uses one of the oldest, most well known, awe-inspiring myths about the creation of an “ideal” city, Plato’s Atlantis. Following Plato’s original descriptions as guidelines for the environment and city designs. But not only in terms of Atlantis, whose existence is still argued upon until this day, also in terms of a range of other aspects the project utilises the genre of speculative fiction, keeping a generally realistic approach but using the creative licence of fiction to push concepts further and slightly into the fantastical.



Figure 6_ Biophilic columns in the Temple of Khnum, Esna, ancient Egypt ca 249 BC. Brown, P. (n.d.)



Figure 7_ Art Nouveau staircase by Architect Victor Horta at hotel Tassel, Brussels, built in 1893. Townsend, H. (2002)

By 2050, the global urban population is expected to have grown by up to three billion people (Population Reference Bureau, 2007) meaning that cities will continue growing substantially and new cities will appear, which raises the question:

What do we want architecture and the cities of the future to look like?

The experience aims to make its audience “think outside the box”, introduce them to architectural ideas that are supportive of mental health and well-being and to stylistically push the boundaries of the existing reality in order to foster creative thinking.

> > 2.3 TOPIC OVERVIEW

Biophilia has been influencing design and architecture for millennia, with some of the oldest examples appearing in ancient Egypt. Its development can be traced through to the Gothic period to the Art Nouveau style of the 19th and 20th century.

Nature-inspired designs are obviously aesthetically pleasing. However:

why else is biophilic design a relevant field to consider when designing architecture?

Dr Vartanian, psychology professor at the University of Toronto, uses MRI scans to explore how architecture can impact brain functions. “The results have demonstrated that people prefer curvilinear to rectilinear objects... and that curvature elicits pleasant emotions” (Vartanian et al., 2013, p.1-2) allowing the conclusion that buildings and environments designed in line with the flowing organic curves of nature have a preferable effect on its inhabitants. And indeed multiple studies dealing with

“Psychogeography” - the science of the “effect of geographical locations on the emotions and behaviour of individuals.” (Tate, n.d.) show that being in nature-inspired spaces can be favourable for productivity (Gale, 2018) as well as mental wellbeing (Thomas et al., 2021). Some research even finds that the integration of nature in built environments can have a Salutogenic effect, for example in hospitals, where it can be an active part of the healing processes of patients (Mazuch, 2017)

Historically, biophilic architecture was exclusively accessible to wealthy institutions due to the high cost of construction. However, Zhao et al. (2019) found that new 3d manufacture technologies that enable the creation of organic, “biophilic” forms can make construction, in fact, more affordable than traditionally built housing (ZHAO et al., 2019), therefore making biophilic architecture increasingly accessible to the wider growing urban population.

Organically shaped and nature-centric biophilic architecture contrasts with the two current architectural movements, Modernism and Brutalism, which have shaped the appearance of numerous cities of the 21st century and whose architectural styles are based on repetitive, monotonous, rectilinear shapes that were usually cast in grey “beton-brut”, often devoid of natural elements. Ironically, some of these cities were designed with utopian goals, but ended up becoming dystopian case

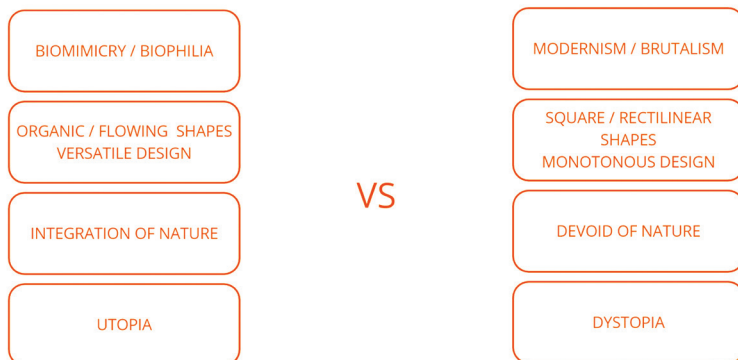


Figure 8a_ Utopia vs. Dytopia. Peters, M (2022)



Above: Figure 8b_ Tecla house by WASP during 3d printing construction. Milano, A. (2021)

Below: Figure 8c_ Finished Tecla house by WASP. Corazza, I. (2021)



Above: Figure 9a_ Supaquadras in Brasilia. De Melo, V. (n.d.)

Below: Figure 9b_ Brasilia. Franca, J. (2007)

studies like for example Brazil's capital city Brasilia. This further supports the assumption of a correlation between architectural shapes and mental wellbeing.

Seeing the multitude of positive aspects of biophilic architecture, it seems obvious that there is use in disseminating this design approach to the wider population, which raises the question:

How can we as concept designers teach an audience about biophilic architecture?

When approaching the education of young adults in 2022, some factors must be considered that did not necessarily play a role in the past. Due to the increased use of social media, attention spans have been reduced dramatically, making it increasingly difficult to convey knowledge and achieve retention (Rahman et al., 2020). One approach that has a proven track record of success is "edutainment", a method which facilitates constructive learning through the experience of events that include emotional and engaging conditions (Anikina et al., 2014). Interestingly, during those events, what seems to stand out as the most impactful factor supporting constructive learning is the experience of awe (Kort et al., 2001).

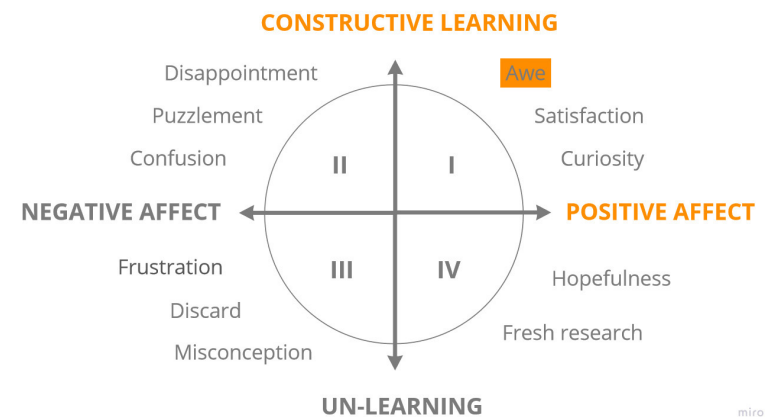


Figure 9c_ Constructive Learning map. Kort et al., P.44 (2001)



Figure 10_ The awe-inspiring set of the elven city Rivendell in the Lord of the Rings - The Fellowship of the Ring. Vanderstelt, J. (n.d.)



Arguably the medium with the highest potential to convey a sense of awe is cinema and indeed, films often use the tool of awe to “edutain” an audience, as for example, in the trilogy *The Lord of the Rings*, (2001 - 2003) which teaches in its subtext about the necessity of taking risks in life as well as ancient nordic mythology.

However, when determining the main format for the fictional project, virtual reality seemed like the obvious choice, as it further pushes the potential to inspire awe (or, speaking in science fiction terms, the “sense of wonder” or “the sublime” of cinema) due to its capacity to present spaces in fully immersive 360 degrees.

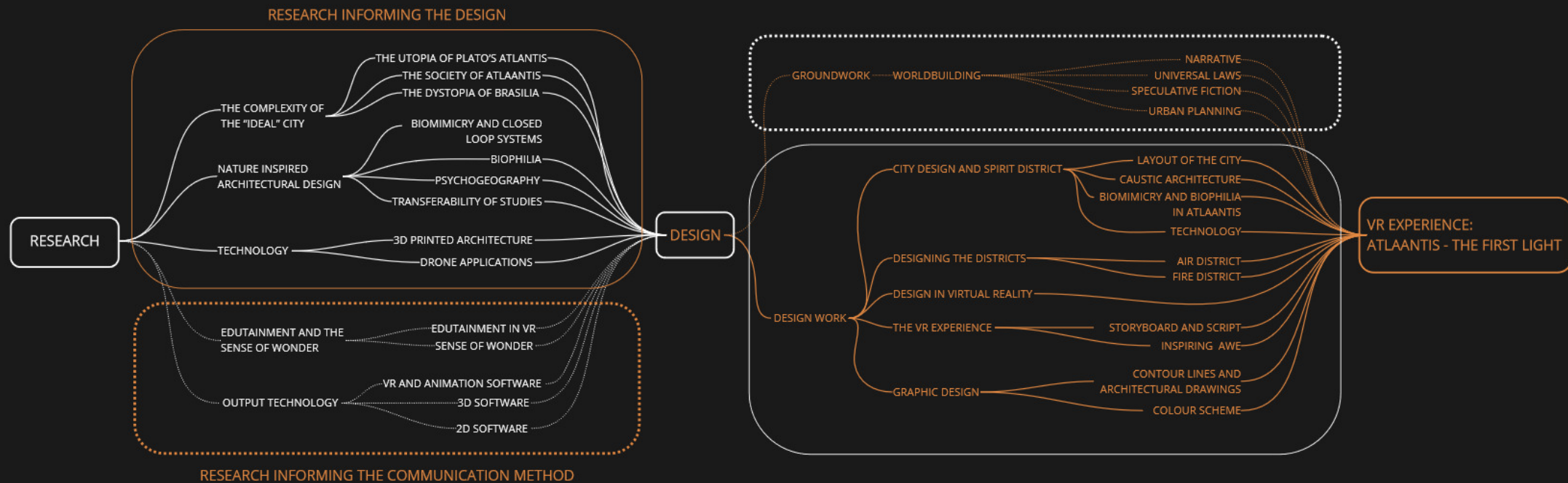
Furthermore the VR format enables the export of multiple output methods, for example videos or 2d prints, allowing for a greater range of distribution possibilities, which helps mitigate its current disadvantage which is the still fairly limited accessibility of VR headsets in 2022.

THIS MDES PROJECT AIMS TO RESOLVE THE QUESTION:

HOW CAN WE AS CONCEPT DESIGNERS HELP BROADEN AN AUDIENCE'S PERSPECTIVE ON NATURE-INSPIRED ARCHITECTURE AND URBAN DESIGN?

Historically we have seen a wide range of examples of formerly unimaginable science fiction concepts that, often in modified form, have found their way into real world science and design, for example Jules Verne's 1887 book *Clipper of the Clouds* which decades later inspired the engineer Igor Sikorsky to build the first helicopter (Ryan, 1995). This supports the assumption that an immersive, speculative fiction VR experience, showcasing environments that push the boundaries of the imagination,

> > 2.4 PROJECT OVERVIEW



has the potential to broaden the audience's view of biophilic design and architecture.

To develop the project, a variation of the design thinking methodology is utilised that offers an organic problem solving strategy to combine the multitude of inputs from a research and technological perspective.

> 3. CONTEXTUAL REVIEW

> > 3.1 THE COMPLEXITY OF THE IDEAL CITY

As the project aims to design an arguably "ideal" environment, some of the research groundwork focused on the concepts of Utopia and Dystopia. The term "Utopia" was first mentioned in 1516 by Thomas More and describes "an imaginary community or society that possesses highly desirable ... qualities for its members" (Utopia, 2021) with characteristics like freedom, harmony and moral values.

The theory of utopia serves the purpose of exploring visions of what an ideal version of society can look like. While attempts at transforming utopias into reality can fail, as in the later discussed example of Brasilia, they are useful as a theoretical exercise in order to inspire a society as to what could be. Nevertheless, it is important for designers to consider failed attempts at making utopian designs real to understand what pitfalls to avoid.

> > 3.1.1 THE UTOPIA OF PLATO'S ATLANTIS

Plato mentions Atlantis in his writing *Timaeus and Critias* (360 BC) which counts as the first recorded Utopian concept in history.

In the two dialogues, Plato (2008) describes Atlantis as a city that existed around 9000 BC and whose citizens were highly advanced, moral and spiritual people who lived in a progressive utopian civilization. However as time passed, society grew exceedingly greedy and morally bankrupt, causing the gods to bring a cataclysmic disaster over the city which resulted in its destruction and submergence into the sea (Plato, 2008).

The myth of Atlantis is now over eleven thousand years old, and yet the concept is still relevant today. Not only does the idea of the sunken city continue to inspire designers and scientists alike, but some of the societal qualities are also still applicable, for example the equality aspect of enabling every human being to realise their full potential (Plato, 2008) as well as the topic of destruction due to greed which could be compared to the destruction of the environment today due to the greed inherent in capitalism.

> > 3.1.2 THE SOCIETY OF ATLAANTIS

The main focus of this project is the spatial and environmental design of the fictional VR experience. Still, to fully understand the design choices, it seems crucial to also briefly outline the narrative context, that is, the imagined society that is returning from space to inhabit the city of Atlaantis.

As returning people who generations ago had to flee their scorched home planet, the new Atlaantians have learned from the past and have vowed never to repeat the same mistakes that contributed to the destruction of the planet. Originally from a capitalist society whose consumerism took too large a toll on the environment, the new generation is now aiming to live in a more balanced economic system, inspired by the economist Kathe Raworth's *doughnut model*, which sees an ideal economy as one in which "the needs of people are met without



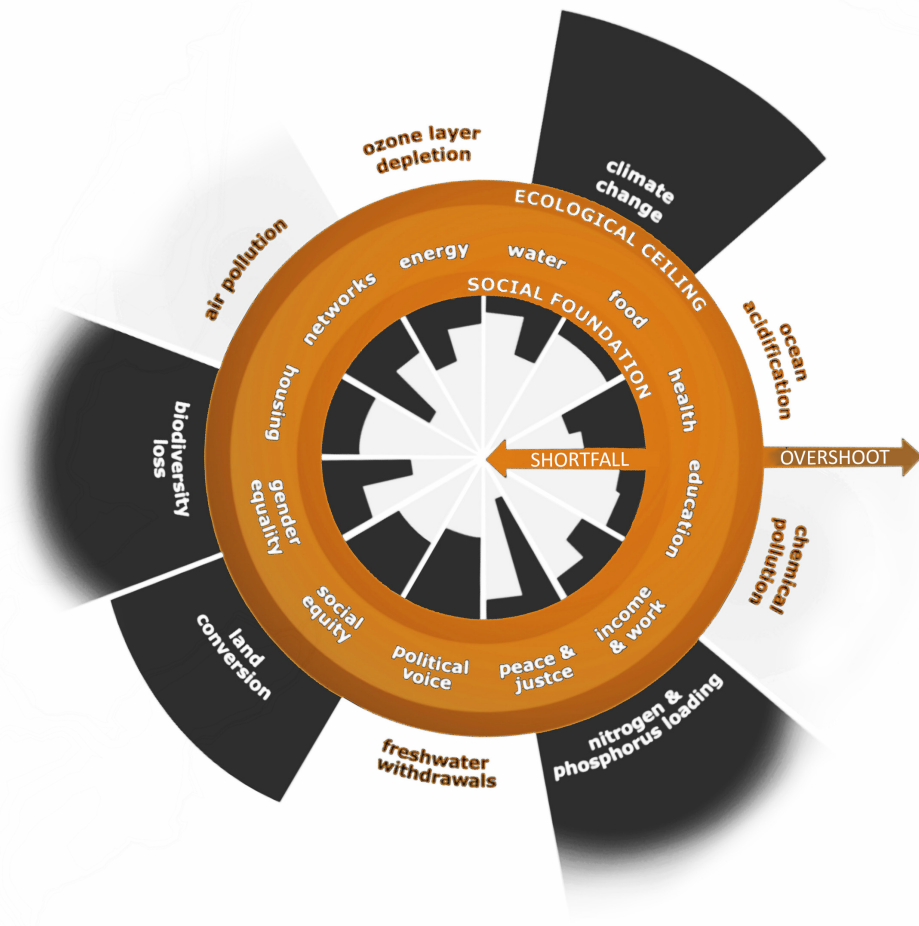


Figure 12_ The Doughnut of social and planetary boundaries.
Raworth, K. (2017)

overshooting Earth's ecological ceiling" (Raworth, 2017).

The social system of Atlaantis is modelled after the social democratic system of central and northern european countries like Germany, that have a strong focus on equality in terms of voting rights, freedom of speech as well as a decentralised government.

In terms of population density, the project proposes decentralisation wherever possible.

This is seemingly in conflict with the urban population growth described at the beginning of the exegesis. However, the project takes an "idealistic" approach and envisions many cities with smaller populations, which enable society to live in communities of around 150 people. This concept is based on Robert Dunbar's finding that 150 seems to be the maximum number of people a human is able to maintain meaningful relationships with (Dunbar, 2021).

> > 3.1.3 THE DYSTOPIA OF BRASILIA

To understand what a good, utopian city might look like, we need to understand where dystopian cities went wrong. Brazil's modernist capital city Brasilia was pre-planned and built in its entirety between 1950 and 1960. In "Building No Place - Oscar Niemeyer and the Utopias of Brasília", Martino Stierli, the head curator at MoMa New York, observes that Brasilia was originally "built and designed with a belief in a better future and ... intended as a representation of an ideal society and thus as a place of political and economic equality" (Stierli, 2013, p.8). During the building process, however, parts of the city descended into more of a dystopian nightmare. For example lacking accommodation for labourers resulted in uncontrolled sprawling of favelas.

According to Stierli, the main reason for the utopia of Brasilia to turn into a dystopia was the "superimposition of spatial and social concepts from above" (Stierli, 2013, p. 8) and city-planners failing to create a human-centric environment.

The multitude of gigantic monuments that Oscar Niemeyer

designed for the city, which were intended to be true democratic meeting points, in reality turned out to be intimidating “non-spaces”, which failed to attract human interaction.

The square and monotonous forms of the modernist and brutalist architecture, which also exceeded the human scale, created a dehumanising environment. Brasilia, thus, serves as a clear counterpoint to the biophilic architecture used in my project.

The research into Brasilia prompted to create a human-centric city at the human scale for the project, mostly avoiding tall vertical skylines and keeping the faces of the buildings in a gradual ascent, with undulating organic shapes in line with biophilic design principles.

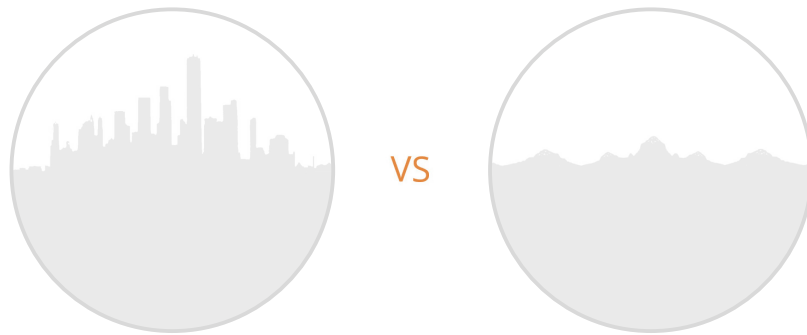


Figure 13a_ Generic vertical skylines vs horizontal human centric skyline of the new Atlantis . Peters, M. (2022)

Furthermore the research into Brasilia and other failed utopias throughout history prompted considering the utopian city not as a complete ideal but as a project in flux and therefore understanding the project’s city of Atlaantis as a project in flux too, open to change and requiring the collaboration and input of its citizens.



Figure 13b_ Modernist architecture in Brasilia, Superquadra Sul. Plentz, L. (1982)

> > 3.2 NATURE-INSPIRED ARCHITECTURAL DESIGN

IF WE WERE TO OVERLAY THE TIMESPAN OF EXISTENCE OF HOMOSAPIENS WITH THE DURATION OF ONE HOUR, HUMANS WOULD HAVE ONLY LIVED CITIES FOR THE LAST

ONE MINUTE

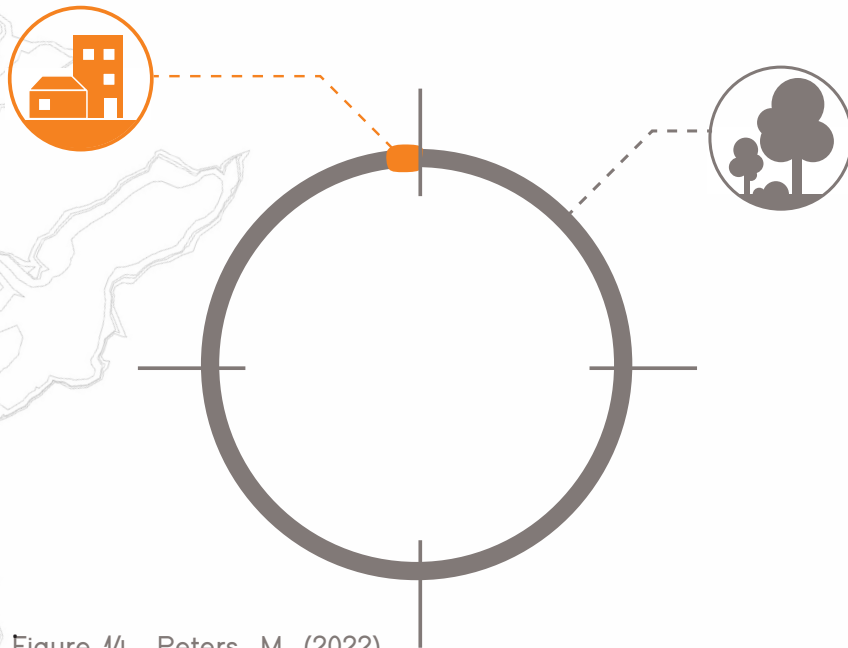


Figure 14_ Peters, M. (2022)

Cities are a very recent development in human history. It is, therefore, no surprise that the connection to nature still plays a big role in the lives of city-dwellers.

The following chapters describe the different types of nature-inspired design, some relevant practitioners in the field, and its potential and psychological impact.

> > 3.2.1 BIOPHILIA

Numerous studies support the notion that humans respond favourably to organically shaped environments reminiscent of nature. Some architects like Friedensreich Hundertwasser have pushed this concept to the extreme, declaring that “the straight line leads to the downfall of humanity” (Hundertwasser, 1997, p. 42).

Following a biophilic approach, Hundertwasser’s buildings push the envelope of architecture far into the natural realm; for example, his houses often have undulating floors hinting at the uneven ground in nature. Hundertwasser also avoids homogenous repetition. Instead, he focuses on introducing varying sizes and shapes and integrates plant life into his buildings.



Figure 15_ Biophilic architecture in Vienna by architect Friedensreich Hundertwasser. Quebec, M. (2005).

However, biophilia not only encourages the integration of plants into the built environment but also supports the integration of other natural elements like water, sunlight, and build materials that are found naturally in the location of construction. Biophilic design further encourages the use of a shape language in line with natural shapes.

> > 3.2.2 BIOMIMICRY AND CLOSED LOOP SYSTEMS

Biomimicry is another nature-inspired design discipline in this project. The term, coined by the biophysicist Otto Schmitt in the 1950's, stands for the emulation of life and nature's engineering.

Biomimicry inspires a growing number of architects and has the potential to play a significant role in spatial and urban design. Michael Pawlyn, a renowned visionary in the field, designed the Eco visitor attraction "Eden Project", which opened in 2001 and draws over a million visitors yearly to Cornwall, UK (pre-covid) (Visit Eden, 2021)

The Eden project consists of a range of bio domes, inspired by soap bubbles and radiolaria, whose attributes are informing the efficient structural design.

Another project of Pawlyn's is the "Mobius project," an urban infrastructure system replicating nature's "closed loop model" of circulating food, waste and energy without producing excess waste or requiring input from the outside (Pawlyn, 2010).

While drawing inspiration from nature's shape language, my project also incorporates the "closed loop model" concept into the city design of Atlaantis and educates about it as a sustainable solution for future cities. Furthermore the Eden project provides a great case study for the project at hand, as it is a microcosm for education in the real world, as much as Atlaantis is as a microcosm for education in the VR experience.

But what exactly happens with us psychologically when exposed to nature-inspired spaces and what specific factors need to be considered when designing such spaces?



Above: Figure 16_Eden Project in Cornwall, UK. Eden Project (2022)

Below: Figure 17_Michael Pawlyn's closed loop concept "Mobius"
Pawlyn, M. (2018)

> > 3.2.3 PSYCHOGEOGRAPHY

Colin Ellard, founder of Urban Realities Laboratory, works in the field of Psychogeography, the science of the effect of geographical locations on the emotions and behaviour of individuals (Psychogeography, n.d.). Ellard claims that our surroundings can have a powerful effect on our thoughts, emotions, and physical responses. When studying the psychological impact of built environments on humans, he found that study participants reacted most positively to green spaces and nature amongst architecture (Ellard, 2015).

A study Ellard conducted in 2013 sent test groups through urban environments and recorded the impact of different spaces through measuring skin conductivity and questionnaires. The findings of this study highlight the following four factors as particularly positive (Ellard, 2013):

1_The inclusion of green spaces and nature in the build environment

2_Open, engaging facades, as opposed to closed monotonous fcades

3_Λ good balance between complexity and diversity on micro scale (buildings) and order and structure on macro scale (layout of districts and city, easy orientation)

4_The experience of awe



VS



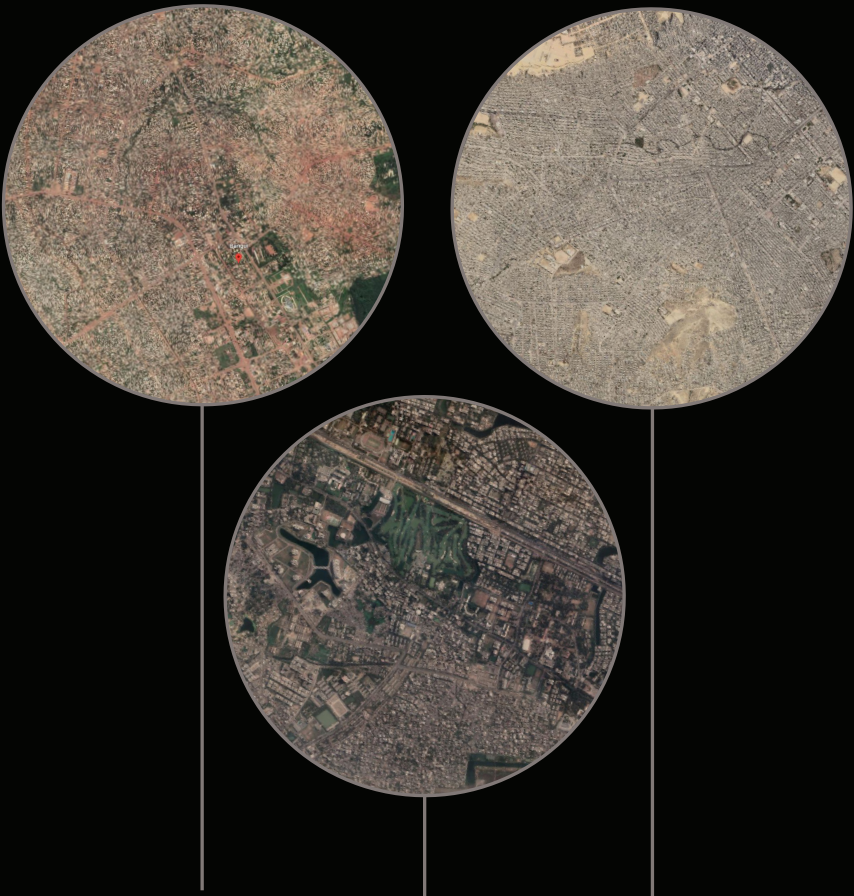
Figure 18_Monotonous closed facade in Frankfurt's financial district on left vs. open and engaging facade in Notting Hill, London on right. Peters, M. (2022)

In figure 19 we see a comparison of satellite images of three of the highest vs. three of the lowest ranked global cities from the annual study “quality of living ranking” by global consulting firm Mercer (Mercer, 2019). And in fact, we find that a multitude of visual clues in line with Ellard’s findings, for example the highest ranking cities all have abundant amounts of nature integrated in the city, in form of green spaces, rivers or lakes and a variation of structure sizes which allows for easy orientation and wayfinding.

MERCER'S QUALITY OF LIVING RANKING

Criteria: safety, education, hygiene, health care, culture, environment, recreation, political-economic stability, public transport and access to goods and services.

SELECTED WORST RANKED CITIES GLOBALLY



Dhaka, Bagladesh Bangui, Central Afrika Karachi, Pakistan

5 KM

SELECTED BEST RANKED CITIES GLOBALLY



Zurich, Switzerland Auckland, New Zealand Vienna, Austria

5 KM

> > 3.2.4 TRANSFERABILITY OF STUDIES

However one big question is left unanswered:

As the project is concerned with designing environments in virtual reality rather than in the real world, how transferable are those studies mentioned in the preceding chapters?

A range of examples mentioned by Ellard's book *Places of the heart - the psychogeography of everyday life* allow the conclusion that the studies are indeed transferable from the real to the virtual world.

In fact, Ellard (2015) includes studies in which participants manoeuvre both real-world and virtual realities. For both environments, outcomes were nearly identical. (Ellard, 2015, p. 180). For example in one experiment participants were tasked with finding their way through a multitude of virtual and real world environments, in real world as in virtual reality high density and monotonous architecture proved to be rather disorientating while open streets and a variety of sizes and styles of buildings proved helpful (Ellard, 2015, p. 180).

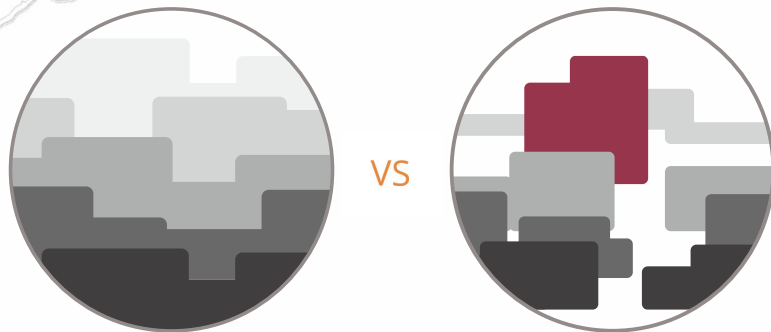


Figure 20_ Wayfinding. Peters, M. (2022)

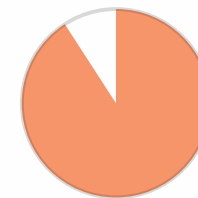
Furthermore a study called "Restorative Effects of Virtual Nature Settings" by Ellard and others found that "restorative effects can be elicited using computer-generated nature and VR" in a similar way as observed with real nature examples (Valtchanov et al., 2010, p.504)

> > 3.3 EDUTAINMENT AND VR

Edutainment is an approach that offers an alternative to the arguably monotonous, traditional way of learning, with a more engaging and entertaining way of conveying information, for example by using mediums like film, games and augmented as well as virtual reality. Statistics suggest that edutainment has a huge potential for education especially in combination with virtual reality (Vlasova, 2020).



ONLY 30% OF WHAT STUDENTS HEAR AND 20% OF WHAT THEY SEE IS BEING REMEMBERED BY STUDENTS IN TRADITIONAL CLASSROOMS.



IN COMPARISON 90% OF THE MATERIAL IS BEING REMEMBERED IF IT IS LEARNED THROUGH A VR OR AR EXPERIENCE.

Figure 21_ Edutainment and VR statistics. Vlasova, H. (202)

And in fact we are seeing more and more brands entering the VR edutainment market, like David Attenborough who released two VR documentaries on the platform Oculus in 2021, which make the experience of nature and animals immersive and captivating.

Regardless how successful VR can be as a tool, tother factors need to be considered such as the impact on health and

wellbeing. For example, Dan Markiewicz (2019) urges to “use virtual reality with caution” due to “visual disturbances” (Markiewicz, 2019). A notion echoed by Betsy Mason (2017) who states that approximately 25 to 40 percent of users experience VR sickness.

There are guidelines that designers can follow to minimise these adverse effects, such as ensuring that a horizon line is visible at all times to support the user’s orientation.

> > 3.3.1 FORMAT RESEARCH

While it is easy to find examples for science fiction’s “sense of wonder”, case studies in line with this project’s focus on edutainment, VR, and biophilia are harder to come by. With VR still being a fairly new medium in 2022, the selection of content is rather limited, therefore next to VR, the project utilised a variety of partial inspiration sources as shown in the infographic on right.

As the project is aiming to “sell” the new city of Atlaantis to its future inhabitants and the audience, the project drew on real estate and tourism adverts, for example the YouTube video “*The Best of Georgia*” (2020), which introduces Georgia as a travel destination and advertises landmarks and activities. This directly informed the macro to micro introduction of the location of Atlaantis and used similar advertisement mechanisms like stunning drone shots portraying the city’s most attractive sites. I also drew on examples of “tourism marketing” in film, for example the 2005 film *The Island*, directed by Michael Bay, which portrays a futuristic world marketing a utopian paradise island, which over the course of the film turns into a dystopian nightmare.

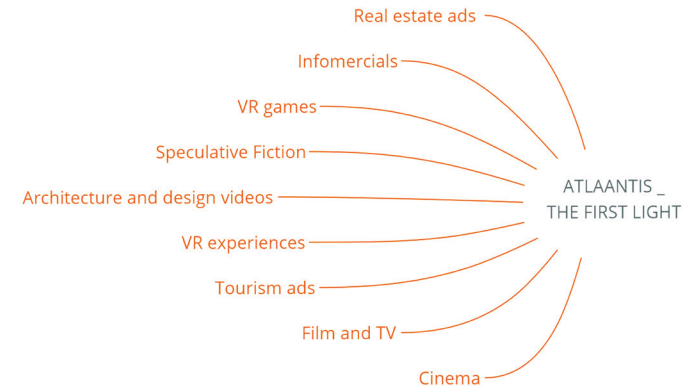


Figure 22_Variety of inspiration sources for the project.
Peters, M. (2022)

In terms of VR experiences, the project looked at multiple case studies, most notably the 3d flying simulator *Avatar Flight of Passage*, designed by Disney and ILM (Disney, 2017). The film inspired the project’s camera shots, which follow flying objects to reveal vistas. The present project has replaced Avatar’s flying ikran – a fantastical creature as depicted in Figure X – with flying drones, as well as the cinematic tools like use of lighting and particles as well as the immersive environment design to convey a *sense of wonder*.



> > 3.4 RESEARCH GAPS AND CONCLUSION

Figure 23_ *Avatar Flight of Passage*, VR experience at Disney's Animal Kingdom park in Orlando, Florida. Disney (2017)

In terms of determining gaps in the available literature, individually, each of the research topics like biophilia, utopia and edutainment offered a large amount of written content, however, in terms of literature that sits at the specific confluence of disciplines that this project engages, the range was very limited which offers an interesting opportunity to contribute innovation.

The contextual framework discussed so far laid the foundation for the following design process, which took the clues and outcomes of the numerous studies as guidance for designing the elements of the new city of Atlaantis and the design of the final virtual reality experience.

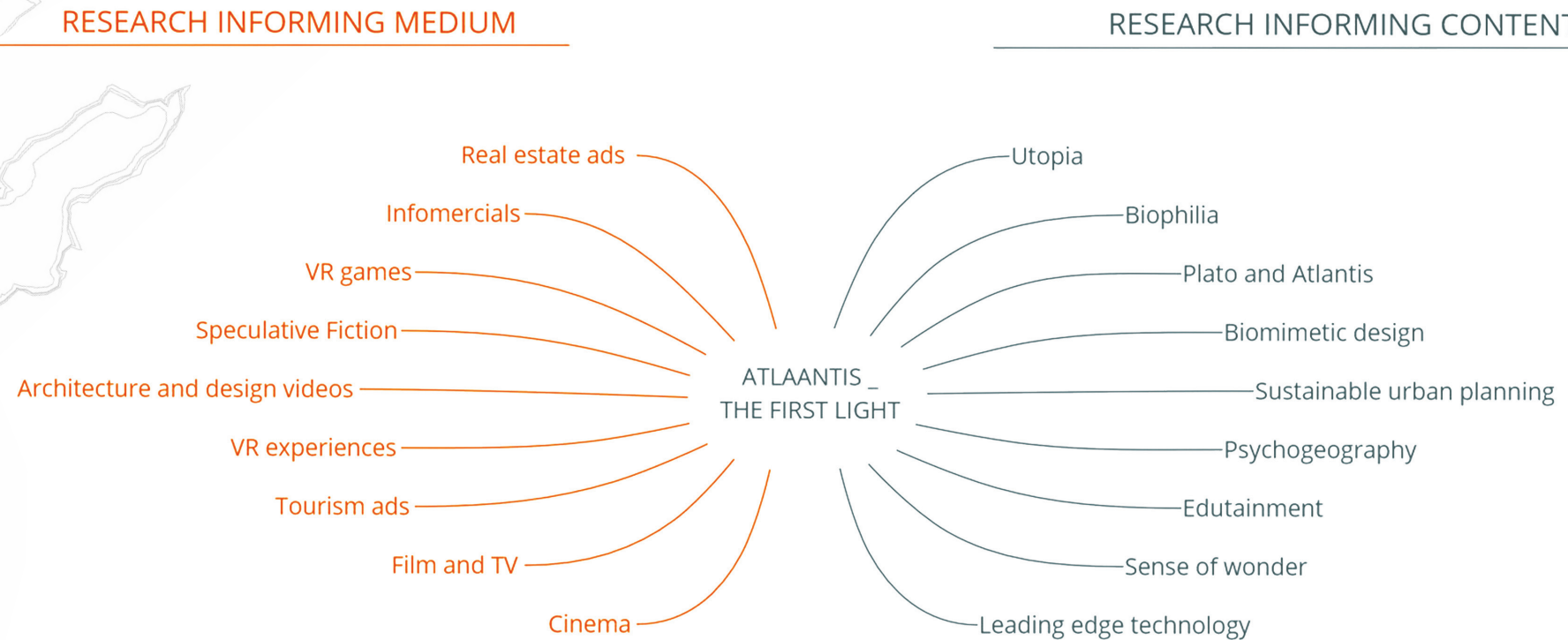


Figure 24_ Confluence of topics informing the project. Peters, M. (2022)



Figure 25_ Wip overview VR experience proof of concept. Peters, M (2022)

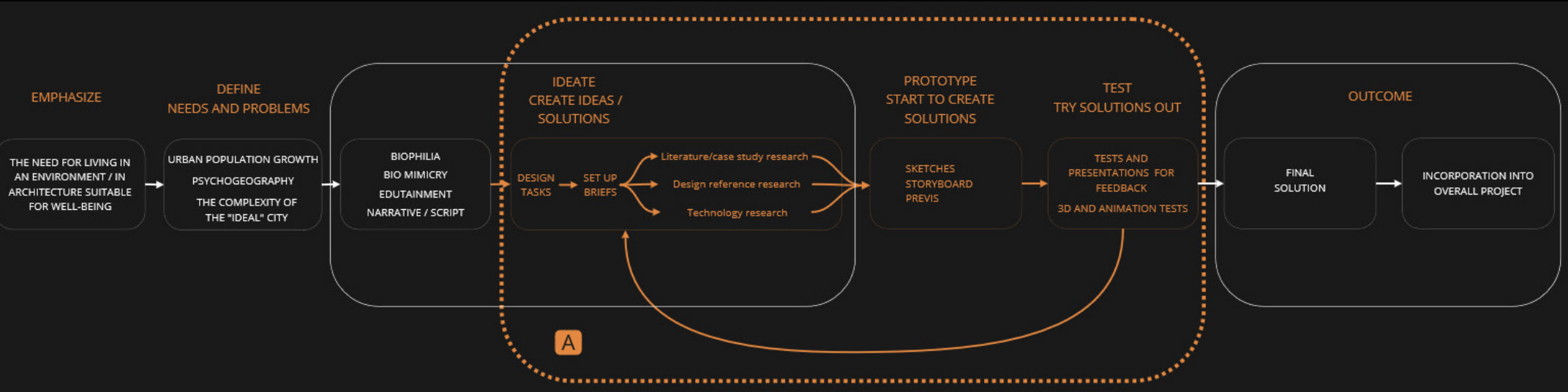


Figure 26_ Design process based on design thinking methodology Peters, M (2022)

> 4. DESIGN JOURNEY AND METHODOLOGY

> > 4.1 GOALS AND METHODOLOGY

HOW CAN WE AS CONCEPT DESIGNERS HELP BROADEN AN AUDIENCE'S PERSPECTIVE ON NATURE-INSPIRED ARCHITECTURE AND URBAN DESIGN?

This project proposes education through awe-inspiring entertainment and speculative-fiction storytelling as a way to resolve the above question.

It was clearly early on that VR, due to its immersiveness and significant potential for education, would be the chosen format.

Given the relative short time period of the Master's programme and the limitation of being a sole researcher and designer, the goal was to create a video proof of concept that showcases the overall vision, including the biomimetic and architectural design styles, biophilia, the edutainment aspects, the tone of narration, the style of animation and soundtrack as well as the graphic design style. This proof of concept can be transformed into a full, high quality VR experience with a larger team and shown in a larger exhibition context.

The estimated duration for the VR experience to cover all relevant aspects was about seven minutes. This would allow it to depict at least three of the five districts of Atlantis and provide a sufficient amount of edutainment examples like infographics and narrative information.

To engage the audience, the VR experience should be based on a speculative fiction narrative, which would be realistic enough to be relatable and informative but fantastical enough to be entertaining, and address the user directly to be as immersive as possible.

To tackle this project, a variation of the design thinking methodology has been utilised.

The methodology, which first emerged in the 1960s in an effort to "scientise" design. It describes a "a non-linear, iterative process that teams use to understand users, challenge assumptions, redefine problems, and create innovative solutions to prototype and test" (Dam et al., 2021).

It is broken down into the five stages: empathise - define - ideate - prototype - test.

In line with the "nature-inspired" theme, it takes a more organic approach in interpreting this methodology for this project.

As the design thinking methodology is a human-centric approach and starts off with empathising, the project started with an analysis of human psychological needs and the psychological impact of architecture, from which the corresponding design language was derived.

Entering the "definition phase", the research focused on a variety of fields aimed at gaining a deeper understanding of the issue, like urban population growth, psychogeography as well as the functionality of cities, urban planning and architecture. Furthermore the aim to create a new version of an "ideal" city led to a need to understand the complex relationship between imagined utopias and attempts to realise them.

Parallel to the topical research a large amount of technology research and upskilling had to be undertaken which divided the workflow for the project's foundation into three fields:

1. academic research
2. design research
3. technological research

In addition the project required the development of an Intellectual Property which would function as a framework to set the scene for the world and have a captivating narrative to



draw the audience in, which resulted in writing the storyline for the project.

Starting with a rough plot idea, the narrative got more and more refined over the course of the project into a detailed storyboard and script, which offered a clear outline of the individual design tasks.

For the execution of each design task, the workflow marked A. in figure 26 was utilised.

Firstly a definition of goals was created.

The second step was to create numerous sketches/ideations and tests based on the brief, which would be reviewed by industry professionals. Based on the feedback, this stage often became a circular process, involving revisions of and changes to the designs until the outcome was satisfactory. Eventually, the individually designed parts were incorporated into the full cinematic animation where sound, voiceover, and visual effects were added.

The process was then repeated on a macro level, where the full animation would undergo the same circle of testing, feedback, and revisions, until the final result was adequate.

> > 4.2 WORLDBUILDING

> > 4.2.1 NARRATIVE AND STORYBOARD

Early on, a first version of the storyline was developed. The narrative established the setting, time, and precedence of the world, setting it in the year 2150, a time when humanity is forced to leave planet Earth and live in outer orbit due to the environmental collapse. The storyline changed multiple times over the course of the project, finally arriving at the idea of an introductory VR experience marketing the new city Atlaantis to its future inhabitants/ audience, showcasing the cities' features and architecture.

The storyline was then translated into a storyboard and script, which provided a definite list of design tasks and other details like narration and sound.

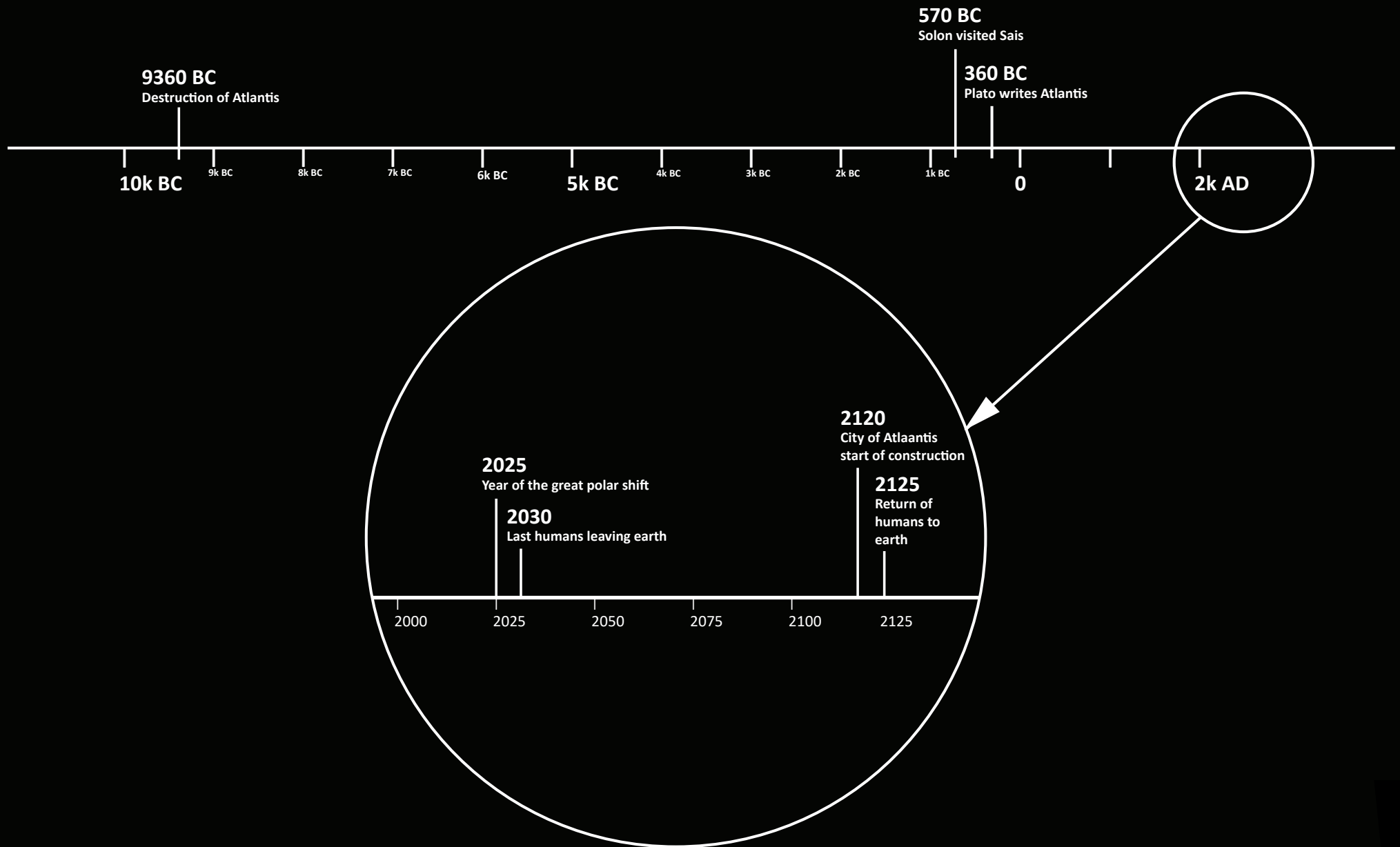
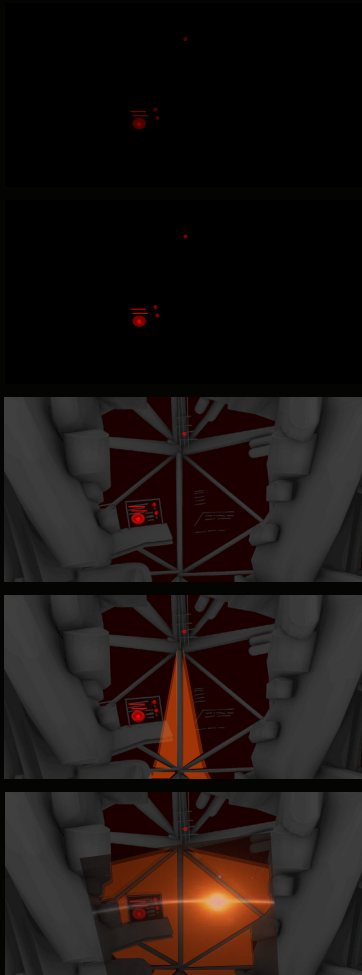


Figure 27_ Timeline of narrative. Peters, M. (2022)

START OF STORYBOARD AND SCRIPT_07/10/21

ANIMATION
SETTING
SOUND AND MUSIC
VOICE
GRAPHICS

Visual Development / Environment
Visual Development / Environment



We are in a small confined space, strapped into a tight seat.
It is black, all we see are a few flickering lights from control displays showing changes of speed and pressure.

Narrator voice is telling the introduction story.
Brief synopsis

Welcome back to planet earth....

The walls of the pod are shaking

and a hissing noise is getting louder and louder.

A transmitter broadcasts broken bits commands:
Re entry in 5 - 4 - 3 - 2 - 1....

900 miles from drop down target...

The hissing noise increases further
and the shaking gets stronger and stonger. Just when it seems to become unbearable, it does one big hit like a big impact

and then it fades into silence and stillness -
Staying a few seconds in stillness -

looking at the control displays which indicate a lowering in altitude and stabilising pressure.

The shutters covering the window of the transport drone pod are slowly opening

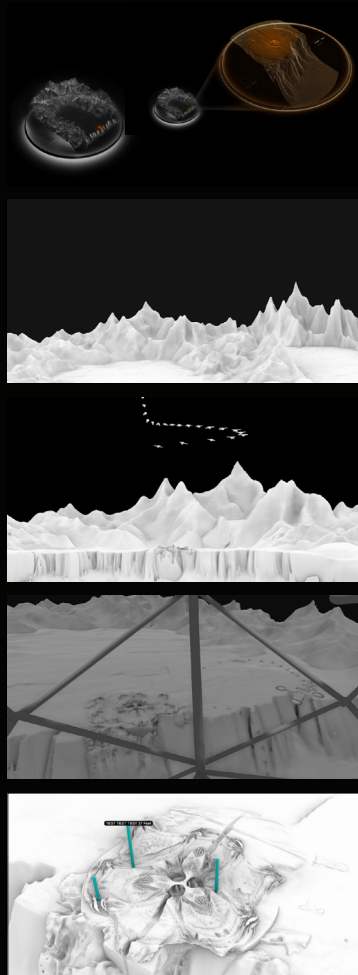
the horizon of earth appears, faintly lit by the first light of the rising sun.

A subtle heavenly choir sounds is audible

the glistening light of the sun breaks through the opening panels

Choir continues

The shutters continue to slowly open
Revealing the sun rising over the curvature eof the earth



Visual Development / Environment
Visual Development / Environment

The display - cockpit screen is now showing a visualisation of the destination of the journey, the foundations of Atlantis (edutainment) first wide - shot then smaller - enlarged version of close up

Voice: talking about plato/atlantis/utopia

Drawing closer a larger mountain range becomes apparent and a plain -

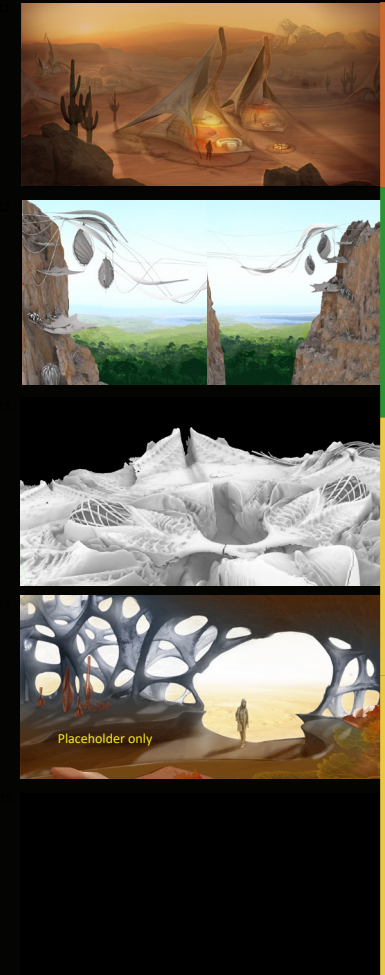
the drone is turning slightly, revealing that we are part of a whole chain of drones descending towards a yet invisible target

drawing closer we see the new city of Atlantis appear, sitting atop a huge cliff face, the drones are circling the city while slowly drawing closer and closer

circling the city

UI / animated graphic elements appear to provide information about the city (edutainment)

Visual Development / Environment
Visual Development / Environment



Fly through Fire district - above ground

UI / animated graphic elements appear to provide information about the district (edutainment)

Fly through Air district "under" ground

UI / animated graphic elements appear to provide information about the district (edutainment)

Landing on highest point of city - overlooking ci / spirit district

UI / animated graphic elements appear to provide information about the district (edutainment)

Interior?! TBC

UI / animated graphic elements appear to provide information about the district (edutainment) TBC

Figure 28_ V1 work in progress storyboards/scripts. Peters, M. (2022)

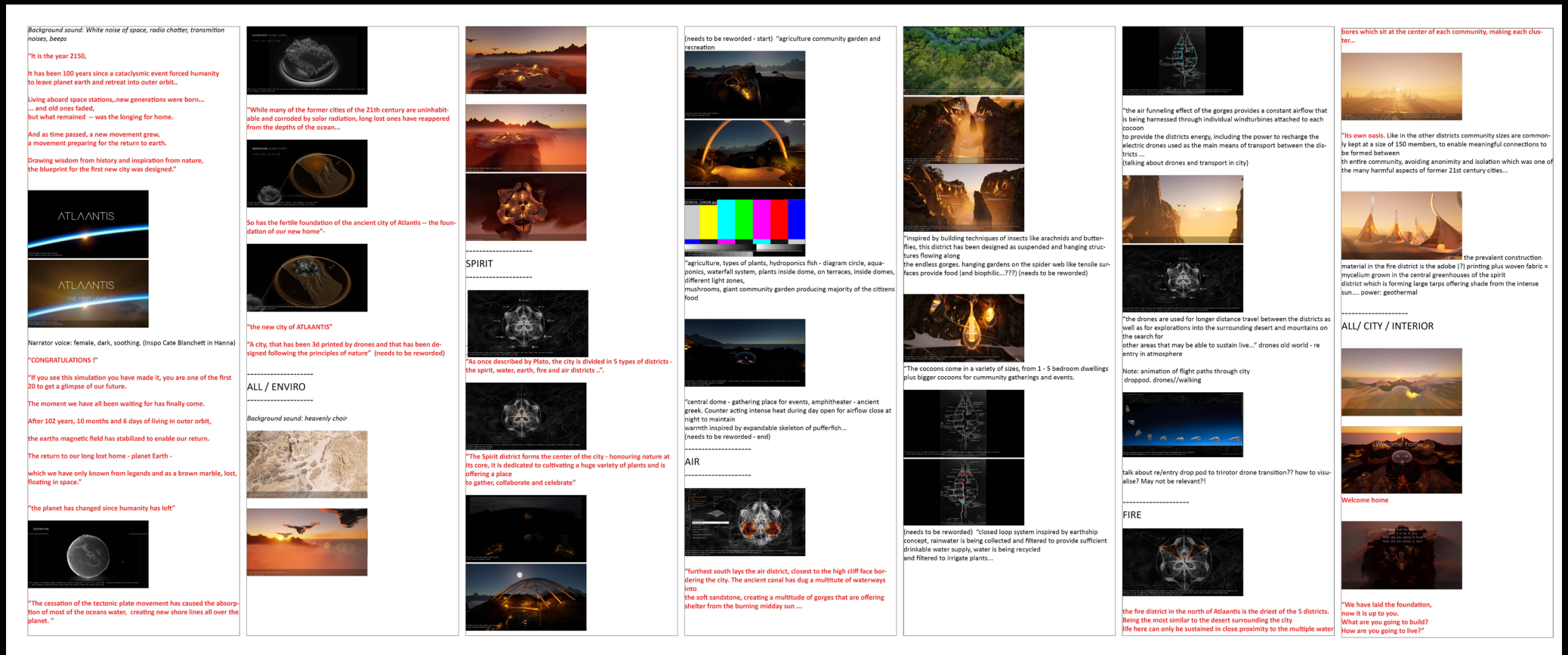


Figure 29_ V2 work in progress storyboards/scripts. Peters, M. (2022)

> > 4.2.2 GROUNDWORK AND SPECULATIVE FICTION

Some groundwork had to be established in order to create a fictional yet believable universe. This included scientific research on a multitude of topics, like the myth and feasibility of the sunken Atlantis and the circumstances that would explain a hypothetical dropping of global ocean levels causing its re-emergence.

Furthermore, an extensive amount of urban planning research fed into the forming of universal laws underpinning the design of the city. These are divided into:

1. Environment, 2. Industry, 3. City, 4. Districts, and 5. Community/home/family. See Appendix 1 for a detailed Breakdown.

In line with the genre “speculative fiction”, the project is essentially grounded in reality and shows an almost possible future, but it takes creative licence and pushes some aspects into the fantastical to serve the purpose of entertainment and sense of wonder, similar to Plato’s exaggerated description of the original Atlantis regarding mountain heights and the size of city, and similar to the exaggerated portrayal of 3d manufacture, like gigantic buildings printed entirely in glass.

> > 4.3 THE PROOF OF CONCEPT VIDEO

> > 4.3.1 PART 1_ INTRODUCTION

> > 4.3.1.1 GRAPHIC DESIGN AND COLOUR SCHEME

As the focus of the animation is edutainment, an infographic design style had to be developed that could be used across the board to convey information. The goal was to make it look

futuristic but relatable, including elements of ancient Greek lettering to tie it back to the original narrative. After testing multiple design styles, the final choice was a fine line design, which was derived by extracting contour lines and wireframes of the 3d models shown in the animation. This created a graphic design style which could be applied to a multitude of designs and which consists of organic, undulating shapes in line with the biomimetic theme of the project. Considering that the final output would be VR, it had to be a design style which could blend seamlessly into a 360-degree environment. Therefore, I chose a light colour on black background, placing the audience inside a black sphere and easily directing the attention towards the light glowing lines. In addition to the white lines, an additional colour was chosen to create colour contrast and highlight elements of interest. In line with the theme of the New Atlantis being an oasis of hope in an uninhabitable landscape, a reddish amber colour was chosen inspired by the desert flower *Adenium*, which is a symbol of hope amongst desert tribes (Floraqueen, 2022). This graphic design style has also been applied to this exegesis.

> > 4.3.2 PART 2_CITY

> > 4.3.2.1 EDUTAINMENT THROUGH THE EXPERIENCE OF AWE

The project proposes edutainment through the experience of awe and cinematic storytelling. In order to generate interest and engage the audience the VR experience is based on an original narrative, which is directly addressing the user as if they are part of the story.

In order to generate a sense of awe, the experience utilises cinematic shots and flythroughs, like for example the first shot revealing the city, here the camera firstly follows a swarm of drones which appear relatively small in the sky, contrasted by the following frames which reveal the immense scale of city, cliffs and mountains.

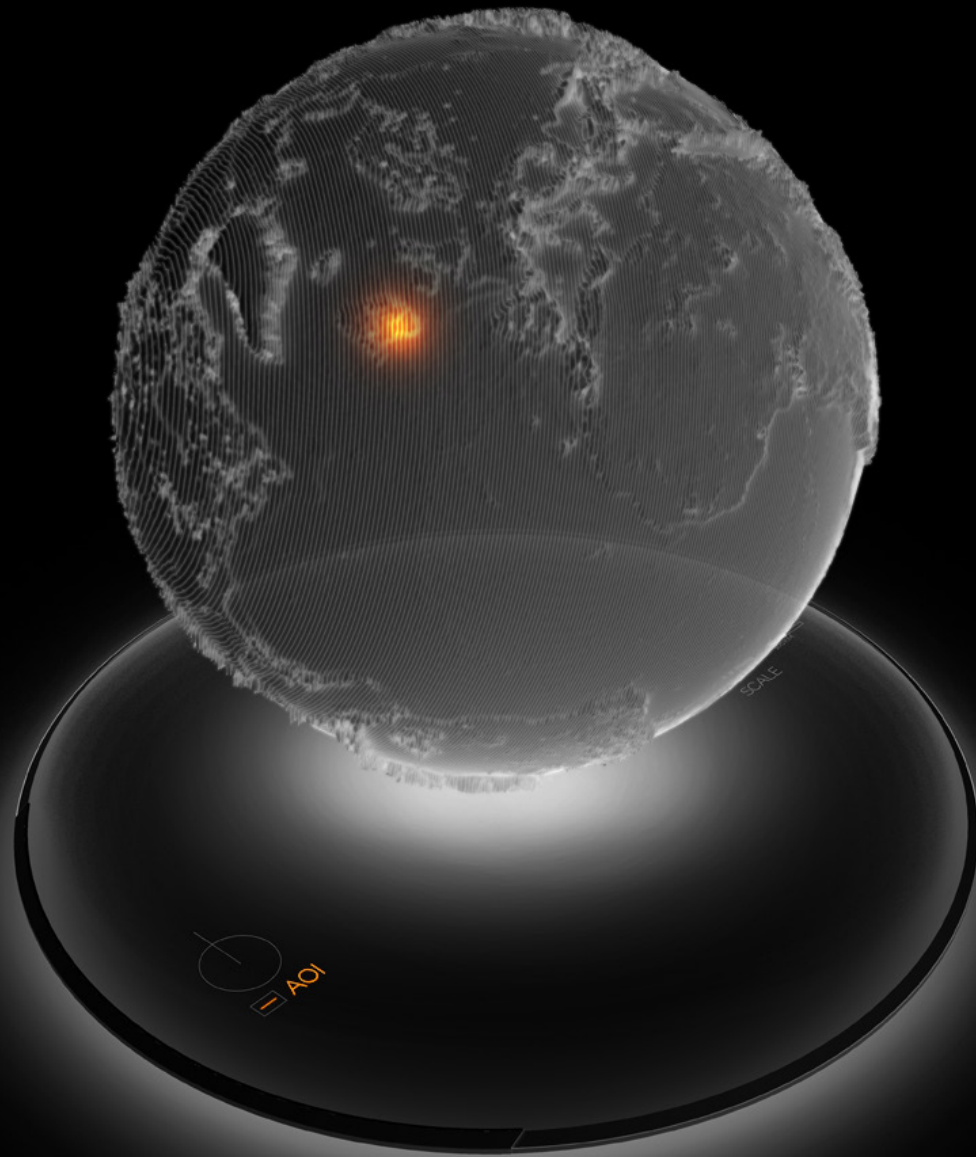


Figure 30_ Design developed for edutainment purposes. Location of the fictional city Atlaantis on planet Earth. Peters, M. (2022)

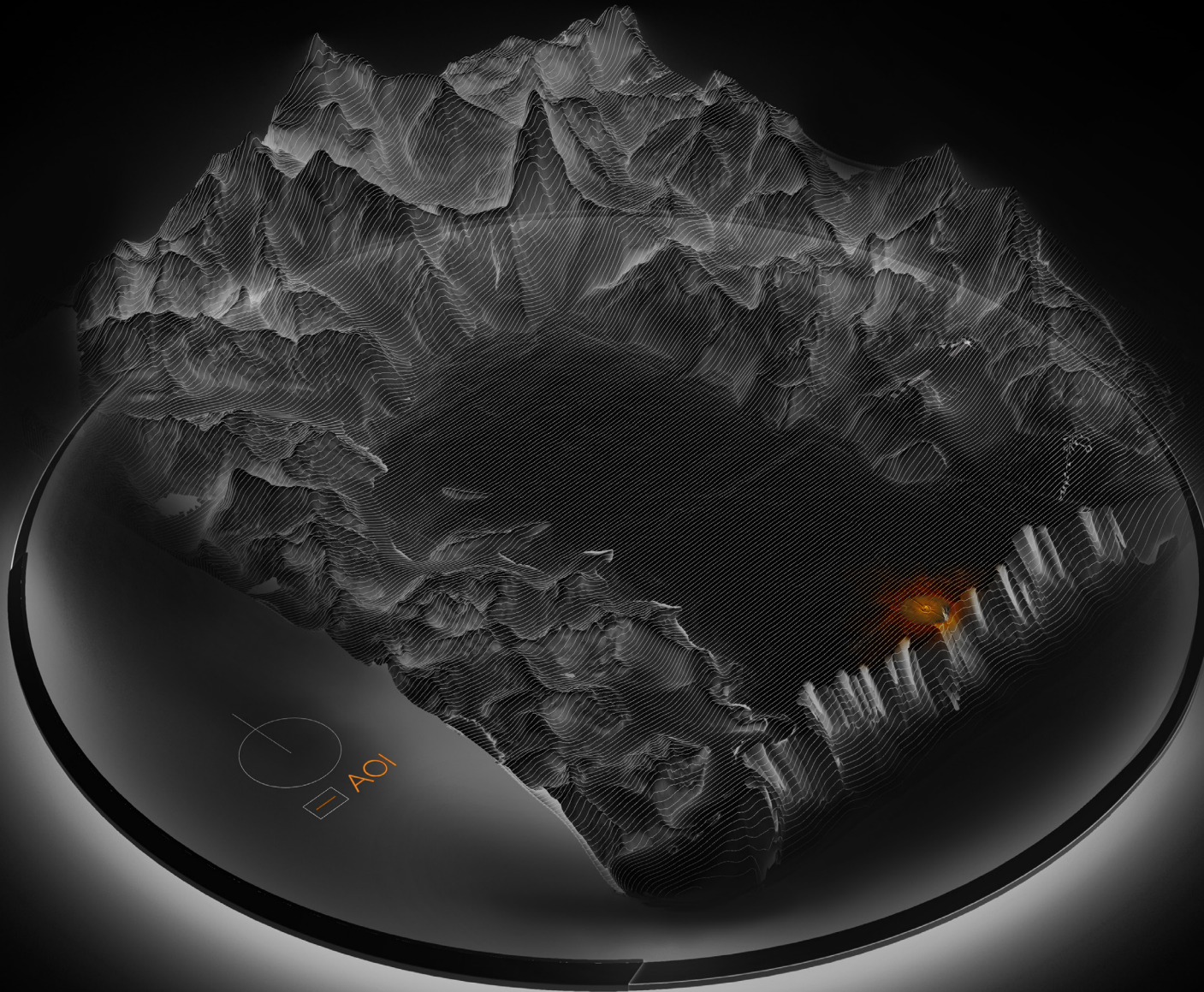


Figure 31_ Design developed for edutainment purposes. Environment of the ficttional city of Atlaantis, modelled based on Plato's descriptions of the cliff, plain and mountains surrounding Atlantis. Peters, M. (2022)

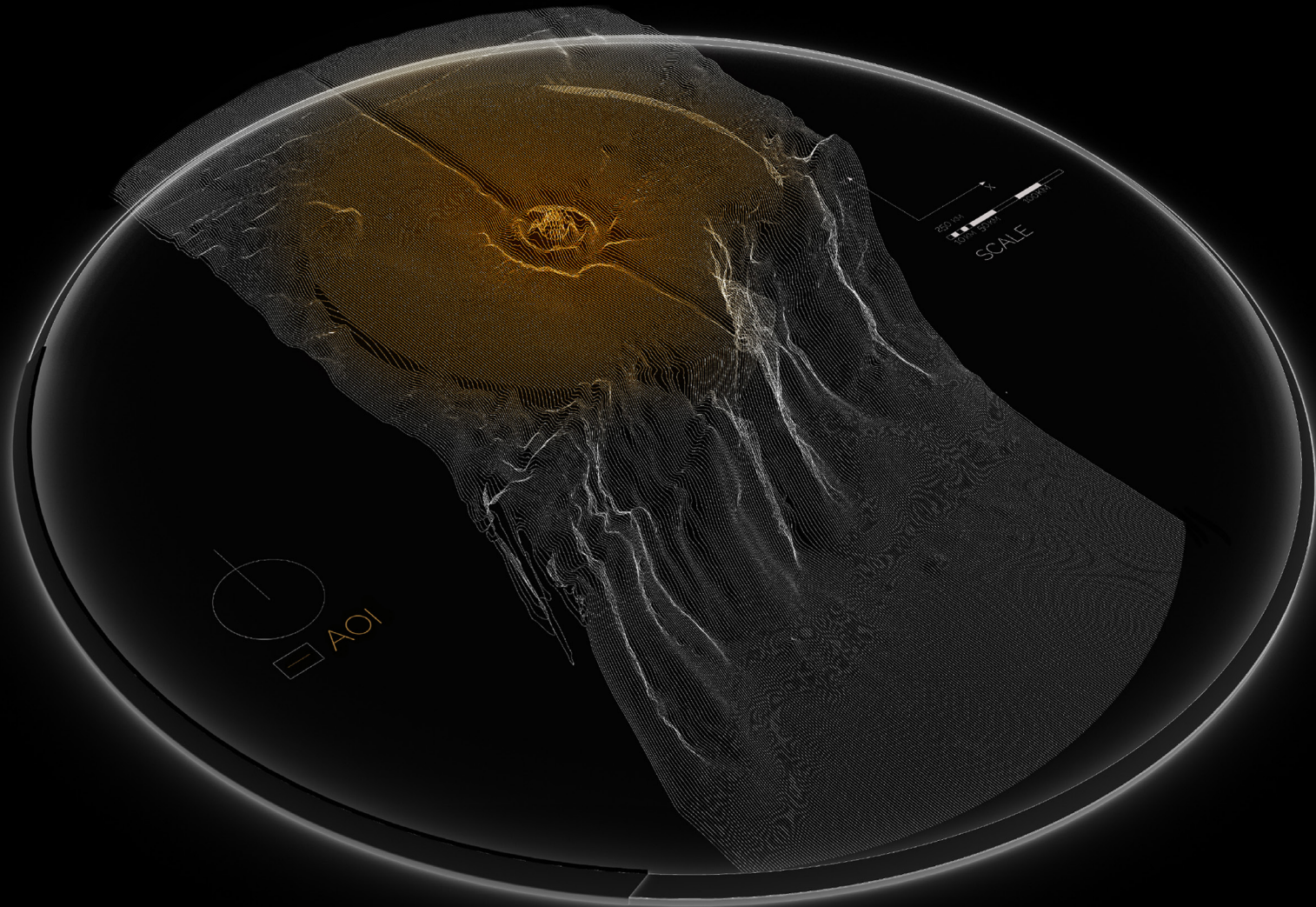


Figure 32_ Design developed for edutainment purposes. Foundation of the fictional city of Atlaantis, modelled based on Plato's descriptions of the cliff, plain and mountains surrounding Atlantis. Peters, M. (2022)

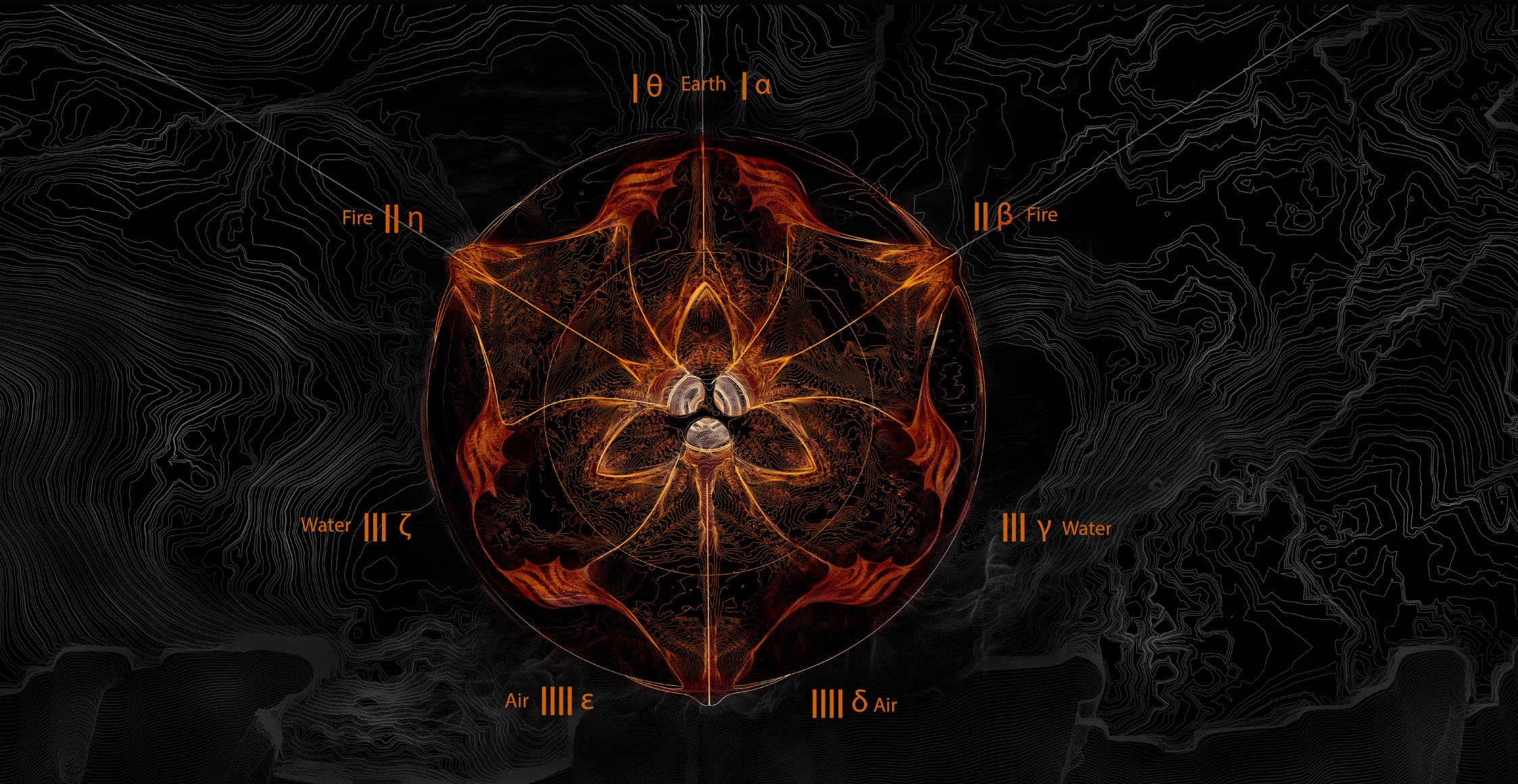


Figure 33_ Design developed for edutainment purposes. Abstract map of Atlantis, showing the location of the districts. Peters, M. (2022)

FIRE || η || β

LOCATION_ COORDINATES	9.1021 N, 18.2812 E
SIZE TOTAL	42.5 km2
POPULATION_CURRENT	14
POPULATION_GOAL	35.000
AVG. COMMUNITY SIZE	150
PRIMARY ENERGY SOURCE	GEOTHERMAL
TEMPERATURE	22.6 C (72.7 F) - 34 C (93.2 F)
CONSTRUCTION MATERIALS	ADOBE (3DE) > MYCELIUM (3DW) >>
POINTS OF INTEREST	ANKAAMABUR, IRIAHS
TRANSPORT	DRONES
PRIMARY FOOD SOURCE	SUCCULENTS, SPIRIT AGRAR

Fire || η

|| β Fire



Figure 34_ Design developed for edutainment purposes. Title card example for Fire district. Peters, M. (2022)

This contrast in scale is aiming to make the user feel small and in awe of their sheer size. Here also the potential of VR comes into play, enabling the frame to take up the users entire field of vision, further enhancing the sense of awe.

Further tools aimed at creating a sense of wonder are:

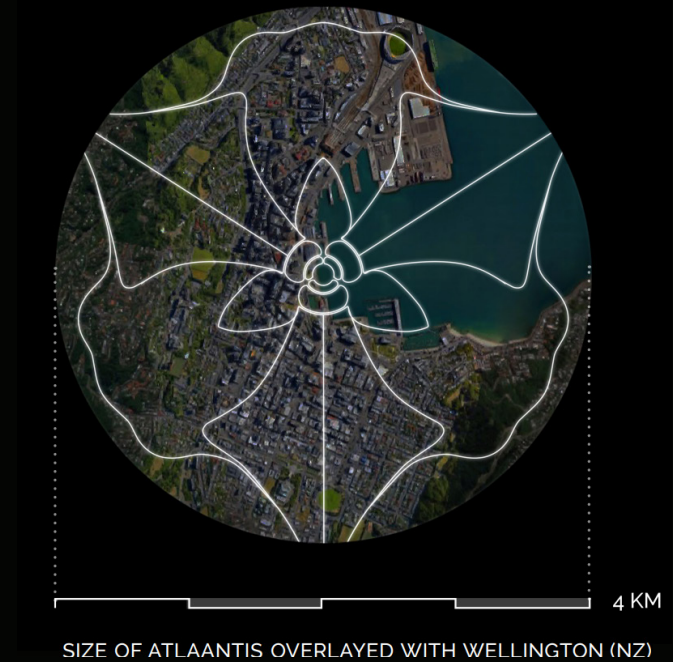
1. the setting of the scene in the late-night hours portraying a full moon cinematically rising behind the majestic mountain range and illuminating the mist and clouds
2. the sound of a choir, which contrasts with the white noise of space the user hears beforehand.

The project mixes those cinematic moments with somewhat dry educational information, in order to use the immersed and engaged state of the mind to facilitate constructive learning.

> > 4.3.2.2 URBAN PLANNING

The design of the city draws on diverse inspirations: First by the original descriptions of Atlantis by Plato, which gave the city its name ATLAANTIS. In contrast to the Atlantis of old, a subtle change with an additional A was introduced to indicate the evolution of language over time. Plato's mythological city also informed the circular shape and central moat design. Second, the city design was inspired by urban planning research and findings of psychogeography, for example in terms of incorporating landmarks for easy wayfinding, considering walking distance in order to reduce traffic, including sufficient areas for agriculture to make the city self-sustainable as well as allowing for a generous incorporation of nature into the city.

Lastly the distribution of housing was inspired by Dunbar's findings as stated in chapter 3.1.2.



Above: Figure 35_ Overlay of Atlaantis with Wellington, for size comparison.

Below: Figure 36_ Walking distance, an important factor determining the size of Atlaantis to minimise traffic. Peters, M. (2022)

> > 4.3.2.3 LAYOUT OF THE CITY

The overall layout design of paths and flight routes in the city was informed by shapes in nature in line with the overall concept of the project. Much like many real cities in the 21st century Atlaantis consists of a vein-like infrastructure, but strictly avoids square grids as common in contemporary cities like for example New York, and instead draws inspiration from more organic fractal like forms like mycelium networks and root systems.



Figure 37_ Mycelium network as inspiration for city layout. Agar (2020)

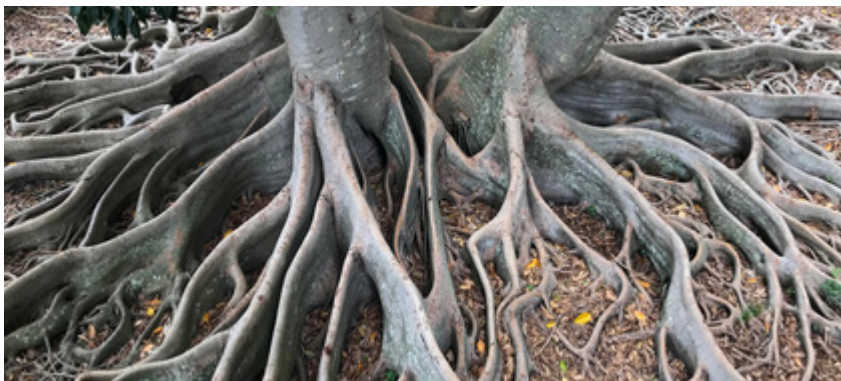


Figure 38_ Moreton Bay fig tree roots as inspiration for city layout. Xavimoose (2018).

> > 4.3.2.4 DESIGNING THE DISTRICTS

In accordance with Plato's description of Atlantis as being governed by five sets of twins, the new city ATLAANTIS was divided into ten districts consisting of five sets of "twin" districts.

In the first design stage the district design was inspired by the five platonic objects, described in Plato's *Timaeus and Critias* as the building blocks for creating the world.

However soon it became apparent that the geometric shapes of the platonic solids were not suitable for supporting the main message of the project's harmony with nature, due to their rather manufactured-looking, square shapes. Instead of the platonic objects, I therefore decided to use the actual elements fire - water - air - earth - spirit as tropes for the districts. Since those elements are not part of "bio", the "alive" nature, but just nature itself, the project extends the term biomimetic essentially to nature mimetic.

For the other districts' ideation, the project followed a horizontal and parallel design approach, starting with sketching a range of architectural styles for each district to develop a library of different architectural design options. This involved incorporating the findings of psychogeography, such as the inclusion of open and engaging façades, the factor of "seeing but not being seen" as well as environmental factors like materials available in the environment or climate considerations.






PLATONIC SOLID:	1. TETRAHEDRON	2. ICOSAHDREDON	3. OCTAHEDRON	4. HEXAHEDRON	5. DODECAHEDRON
ELEMENT:	FIRE	WATER	AIR	EARTH	SPIRIT
NUMBER FACES:	4	20	8	6	12
IMAGE:					
DISTRICT NUMBER:	α θ	β η	γ ζ	δ ε	Π ι Π κ

Figure 39_ The five platonic solids as described in *Timaeus and Critias*. Peters, M. (2022)

1. FIRE



2. WATER



3. AIR



4. EARTH



Figure 40_ Ideation sketches of architectural designs for the different districts of Atlantis. Peters, M. (2022)

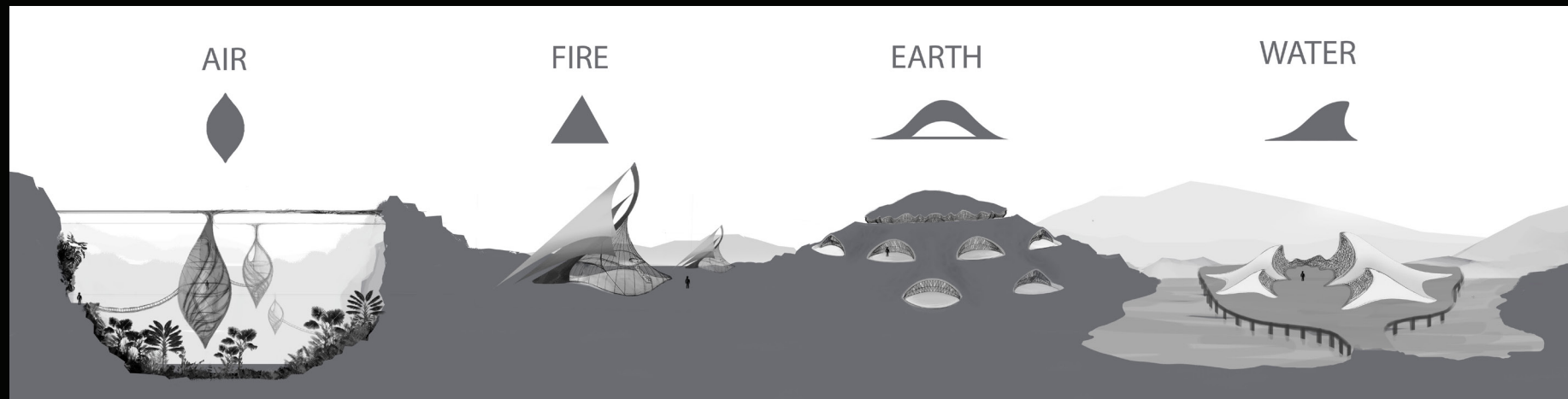


Figure 41_ Final selects of architectural design styles for the different districts of Atlantis. Peters, M. (2022)

> > 4.3.3 PART 3_THE SPIRIT DISTRICT

> > 4.3.3.1 CAUSTIC ARCHITECTURE

Being based on Plato's 5th element: spirit, the design for this district needed to be slightly abstract. Considering Plato's description of Atlantians as spiritual, enlightened people, the district design is inspired by light patterns as metaphor for enlightenment, which included translating caustic light patterns into three dimensional shapes using various 3d software programs.

Next to the strong thematic underpinning, a further advantage of this technique was that it created interesting undulating organic shapes in line with biophilic design.

As they were forming the central part of the city, the buildings of the spirit district had to be large enough landmarks to support easy wayfinding throughout the city, while they also had to stay in line with the "human centric" aspect. Consequently, the buildings have a slowly ascending design, to create a horizontally terraced skyline in line with the "human scale" and similar to the terraced amphitheatres in ancient Greece.

> > 4.3.3.2 BIOMIMICRY AND 3D MANUFACTURE

Supporting the "spirit" concept further, the buildings of this district are 3d printed in glass, giving them an ethereal appearance while educating about leading edge technologies, inspired by an experiment undertaken by Marcus Kayser in 2011 titled "the Solar Sinterer" (Etherington, 2011) which turned sunlight into a laser, to sinter sand into glass.

In line with biomimesis, the idea is that the buildings are being 3d printed hornet-like by a chain of drones bringing sand from the surrounding desert, followed by a chain of drones carrying lenses, sintering and building the levels of the glasshouses line by line.



Figure 42_ Tests for turning light patterns into 3d models.
Peters, M. (2022)

Further biomimetic elements in this district are the roof designs, due to the intense solar radiation in Atlaantis it is paramount to create enough shade and airflow during the day to sustain plant and human life. This is especially true for the greenhouses, which contain most of the city's agriculture.

The design process started off with researching elements in nature providing shade such as tree canopies and giant leaves. These natural designs were then transformed into more abstract solutions like expandable and contractible structures found in nature that could be applied to open the roofs during the day, thus allowing airflow, and contracting them during the night to maintain warmth.

After looking into wing and bone structures, eventually the research led to Pufferfish. The fish's defence mechanism to rapidly blow up and double in body size is made possible by an intricate system of transformed skin spines, which can contract and expand and therefore offer an interesting inspiration for a bio-mimetic roof design of the greenhouses.

High resolution photographs of Pufferfish skeletons helped to inform the shape and mechanism of the scales, which were drawn as 2d vectors, then translated into 3d models and finally applied to the overall dome structures.



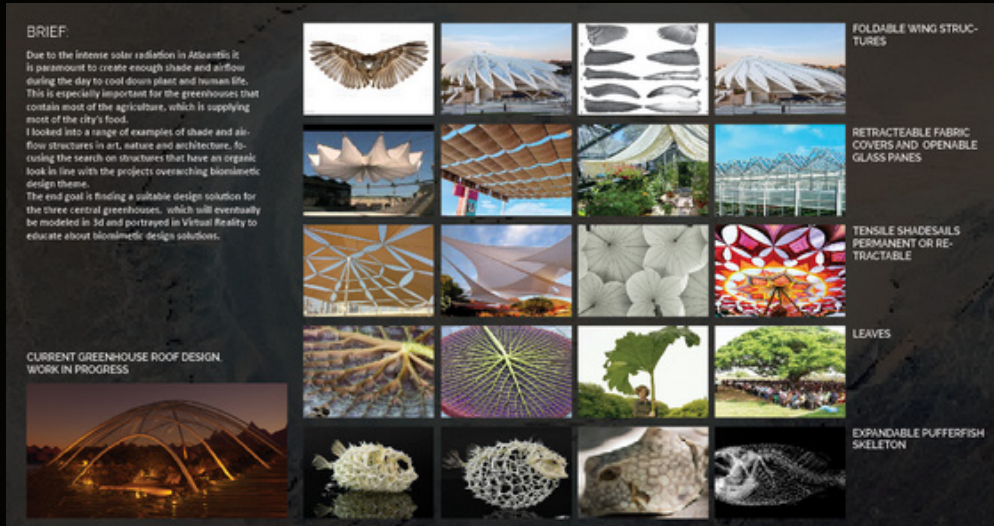


Figure 43_ Brief and reference example for greenhouse roofs. Peters, M. (2022)

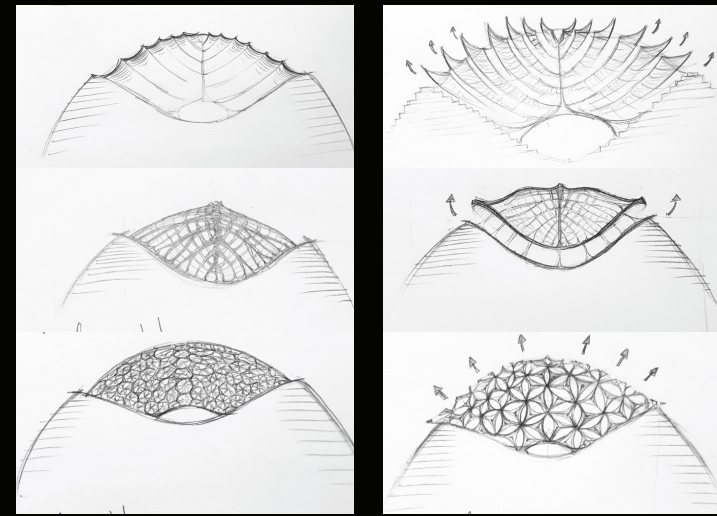


Figure 44_ Greenhouse roof ideation sketches Peters, M. (2022)

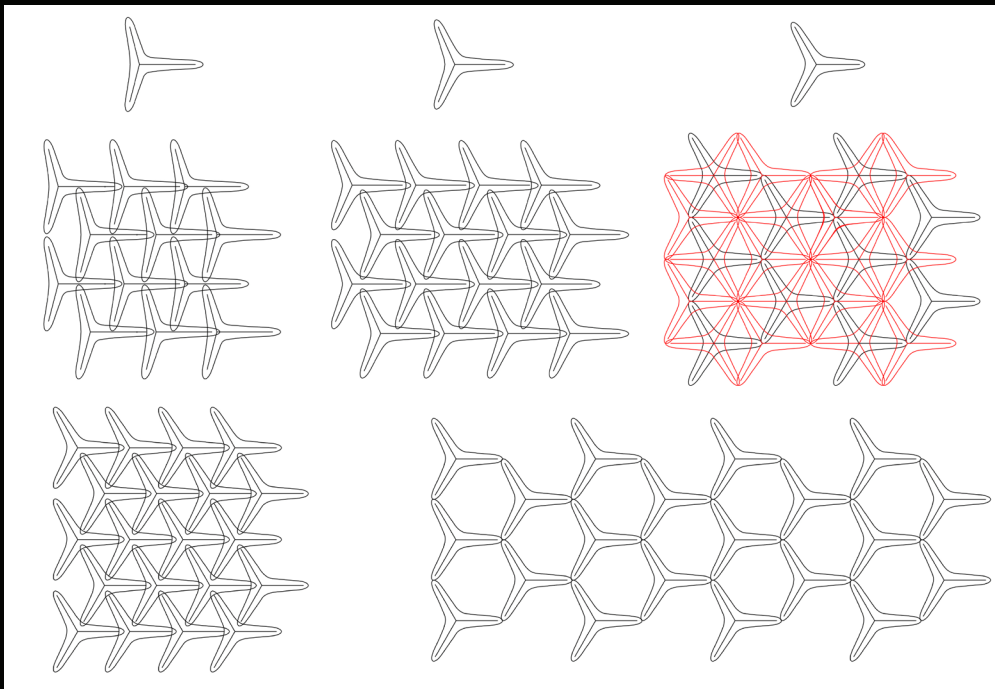


Figure 45_ Design variations for pufferfish spines, contracted vs. expanded Peters, M (2022)

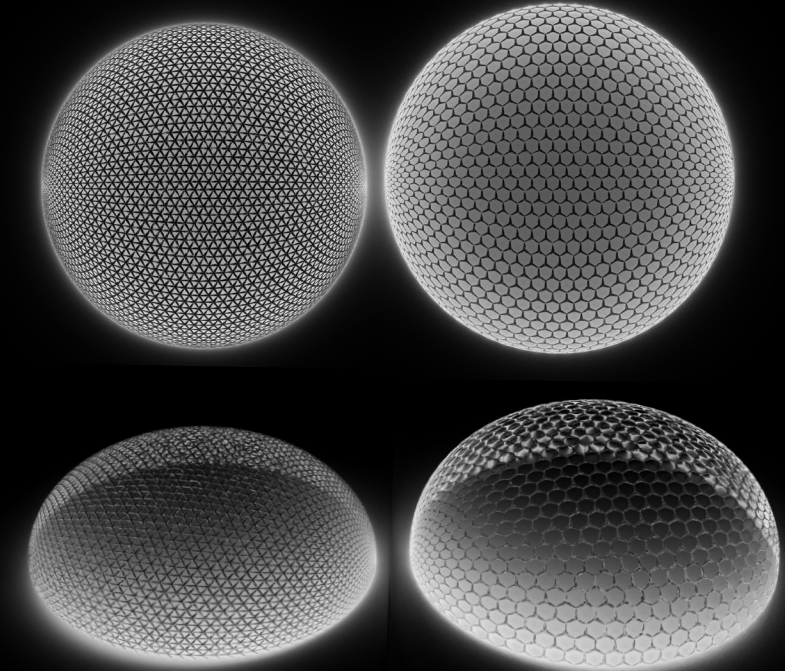


Figure 46_ Pufferfish spine design applied to domes, left: night setting, contracted to retain heat, right: day setting: expanded to allow for airflow. Peters, M. (2022)

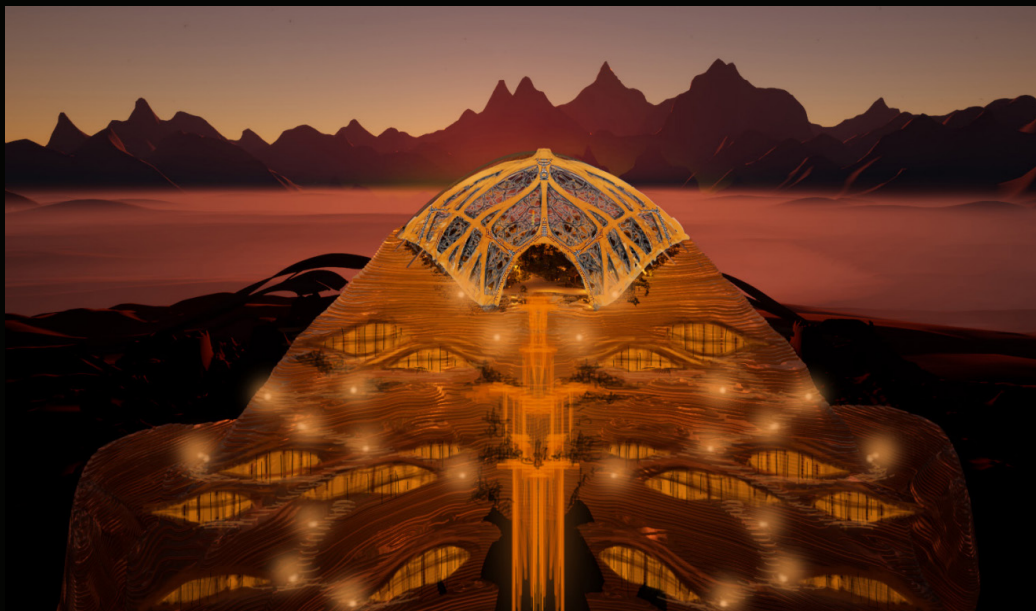


Figure 47_ Greenhouse roof ideation sketch over 3d model. Peters, M. (2022)

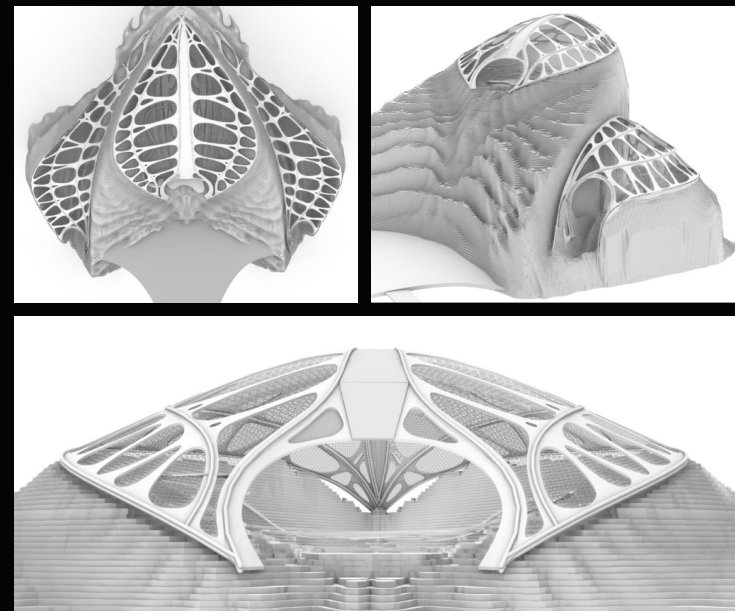


Figure 48_ Work in progress 3d model of greenhouse roofs. Peters, M. (2022)



Figure 49_ Greenhouse roof final design. Peters, M. (2022)

> > 4.3.4 PART 4_AIR DISTRICT

> > 4.3.4.1 BIOMIMICRY AND DESIGN PROCESS

Similar to the Spirit District, the design of the Air District is inspired by biomimicry, in this case by construction techniques found in the insect world, for example those found in Arachnites (cobweb structures for hanging gardens) and Lepidoptera cocoons, forming hanging cocoon habitations. The images below show the complete design process from ideation through to the final design.

> > 4.3.4.2 SUSTAINABILITY

Further topics that the project aims to promote are sustainability and renewable energy sources. While each of the city's districts promotes a different type of renewable energy as shown in the graphic below, the Air District teaches about wind power by means of a cross section infographic, explaining the power generation and distribution through wind turbines, which are part of each individual cocoon, harvesting the wind blowing through the gorge.

Inspired by traditional earth ship concepts the segment about the Air District also educates about a sustainable way of using water. Equipped with a dew- and rainwater-collector at the top of each cocoon, the water circuit provides enough pressure to supply clean water to the kitchen and showers, after which it is being filtered and turned into greywater to supply the toilets as well as watering the vegetable gardens. Finally, a black water tank at the bottom is filtering the wastewater before releasing it back into nature.

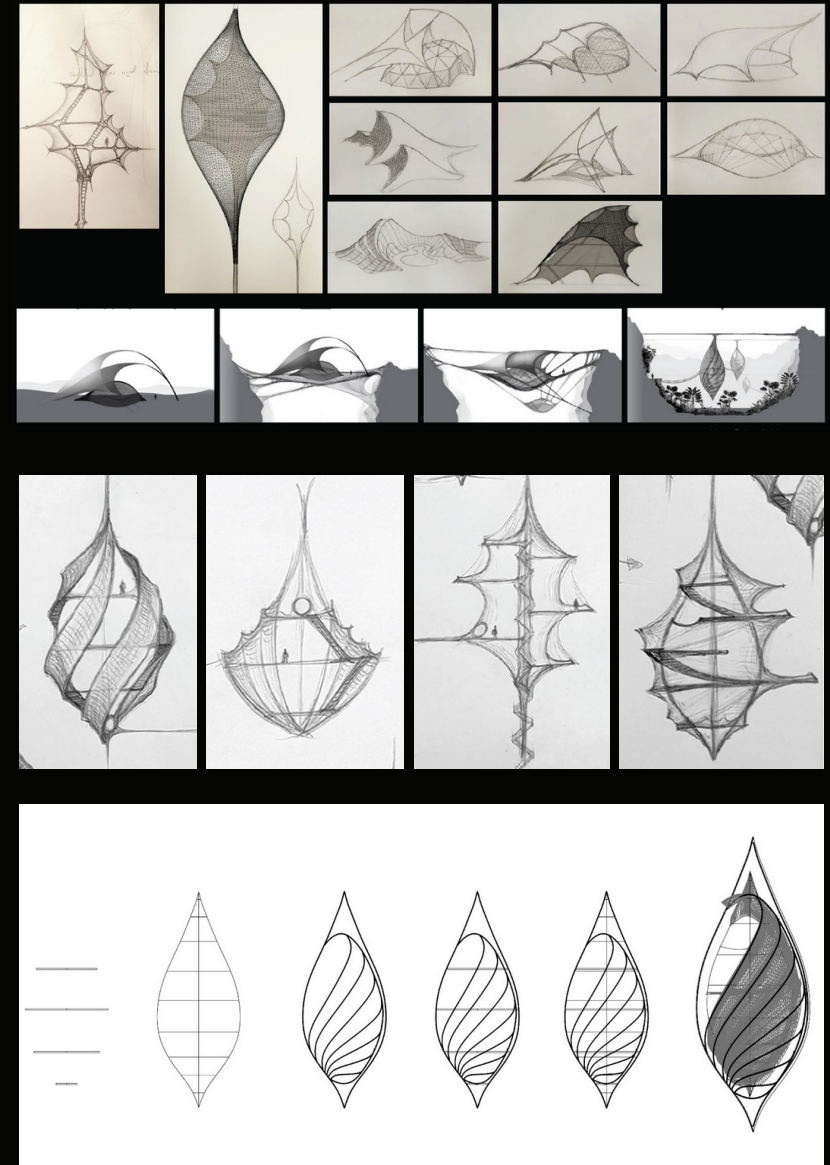
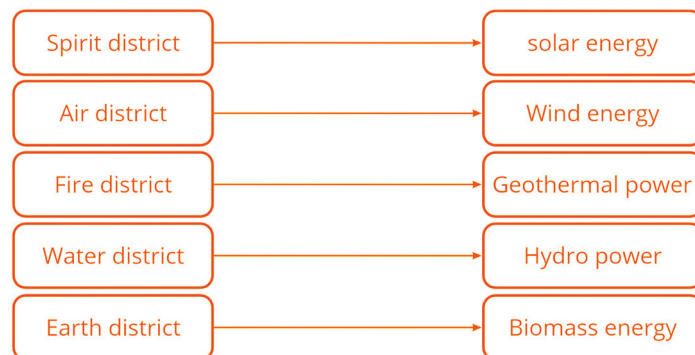
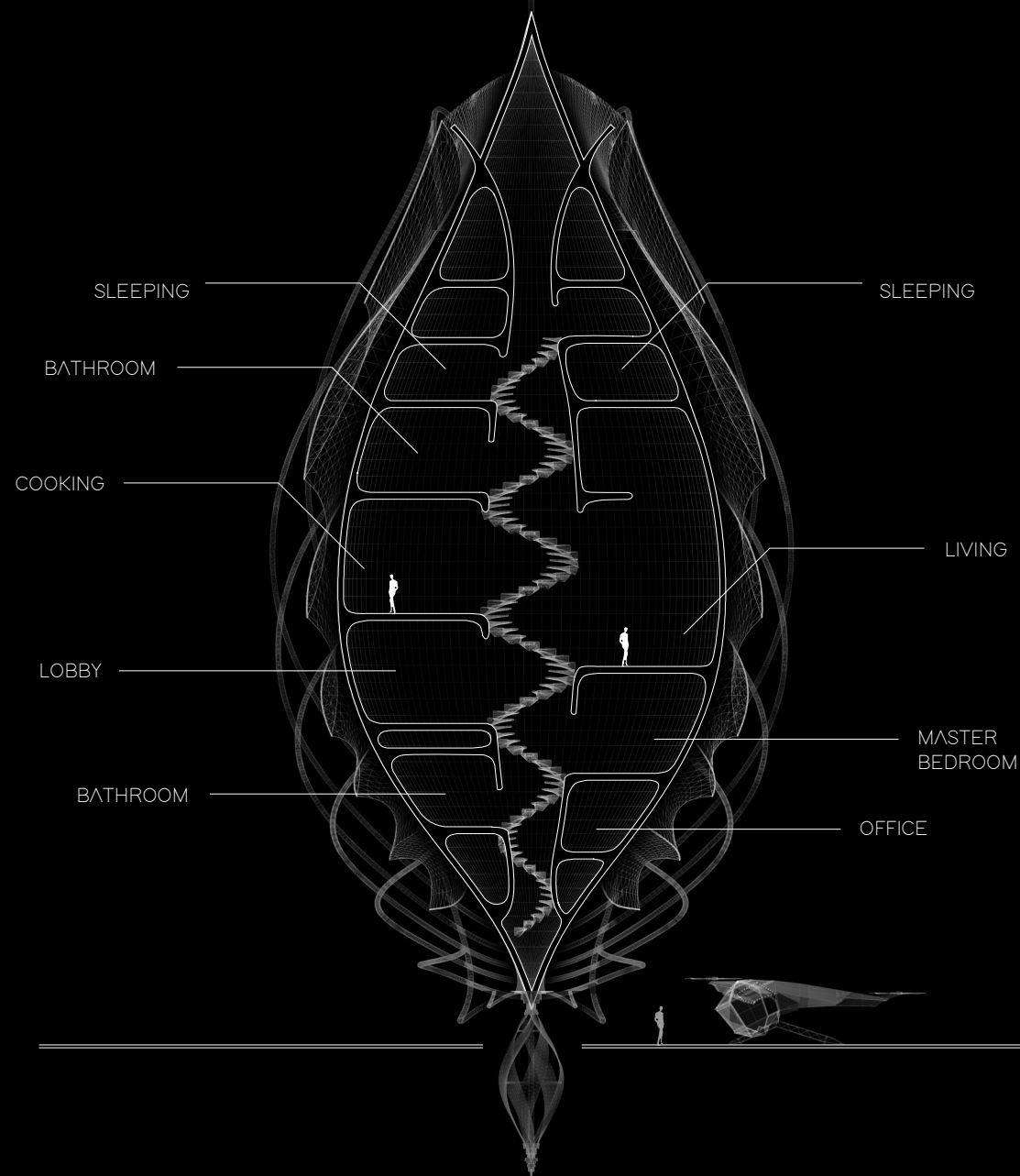
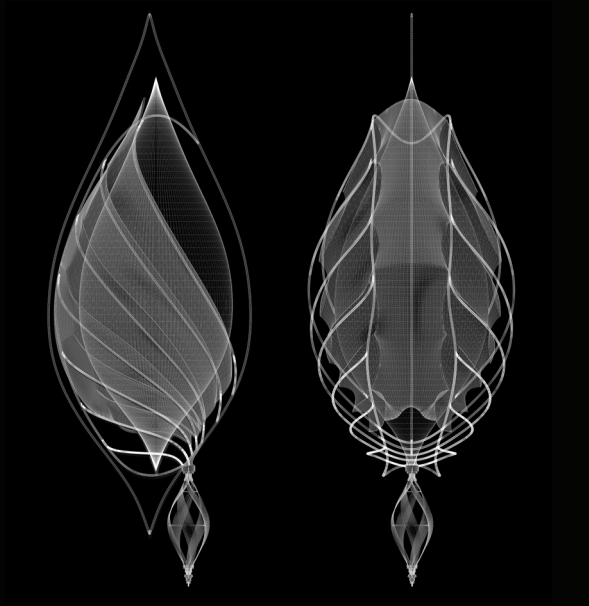


Figure 50 - 68_ Air district design process.
Peters, M. (2022)

On left: Figure 69_ List of the different renewable energy sources for each district. Peters, M. (2022)



Figure 70 - 72_ List of the different renewable energy sources for each district. Peters, M. (2022)



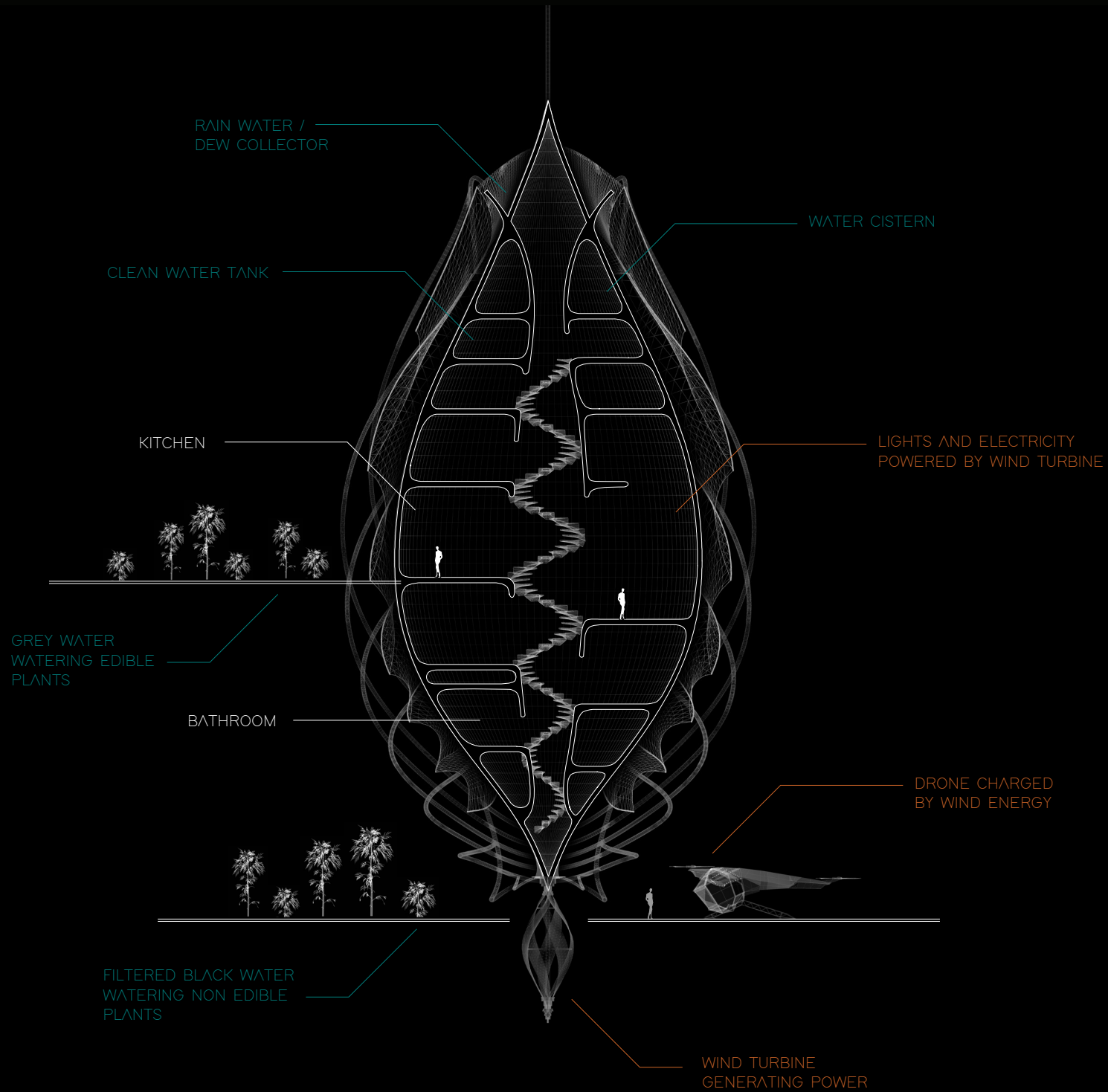


Figure 75_ Air district cocoon concepts. Peters, M. (2022)

> > 4.3.4.3 THE DRONES_ DESIGN IN VR

When designing the drones, the traditional 2d technique proved to be rather limiting. The concept for the drones is based on the idea that they were former re-entry capsules, relics of the old world, which were used by the humans to return to Earth. They transformed into tri-rotor drones upon entering the atmosphere. Emulating this transformation process in 2d to resolve the look of the final drone proved difficult.

Since at this stage the decision was made to create a virtual reality experience, it seemed common sense to start utilising VR tools for the creation process itself. In the case of the drone design, the program Gravity Sketch was utilised to quickly mock up the 3d shapes in VR, which offered the possibility to copy and paste components and rearrange them. It further allowed for the spatial experience of testing the design in real life scale. This process later became a standard approach for architectural designs too.



Figure 76_ Drone design variations in VR/Gravity Sketch. Peters, M. (2022)

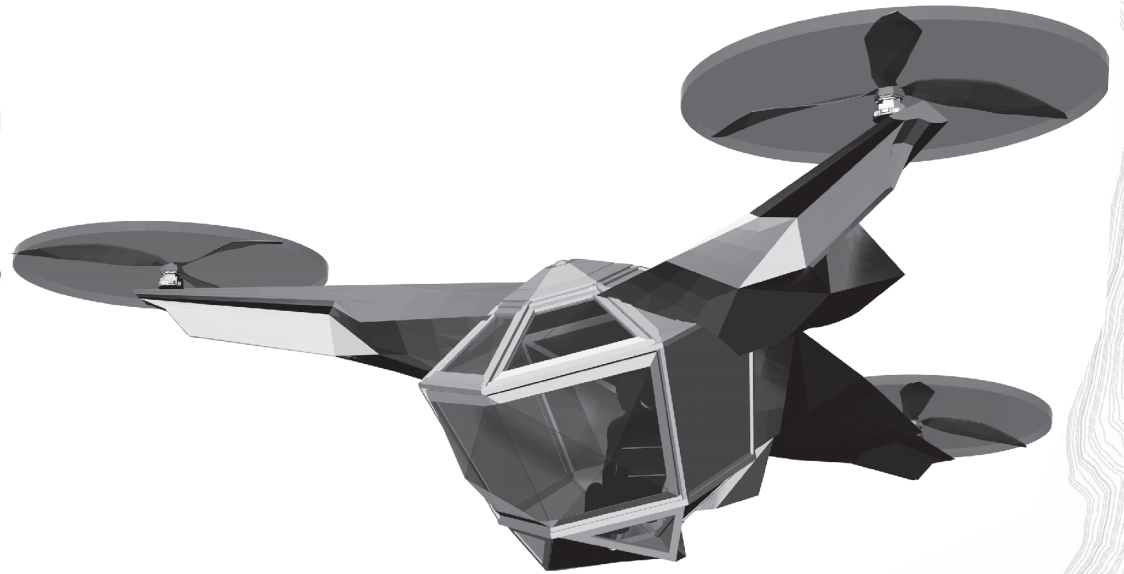


Figure 77_ Final 3d model of passenger drone. Peters, M. (2022)

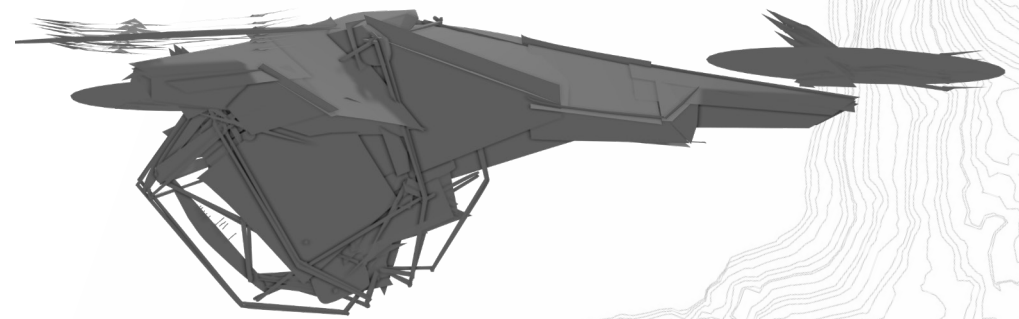


Figure 78_ Rough VR sketch of final style select. Peters, M. (2022)



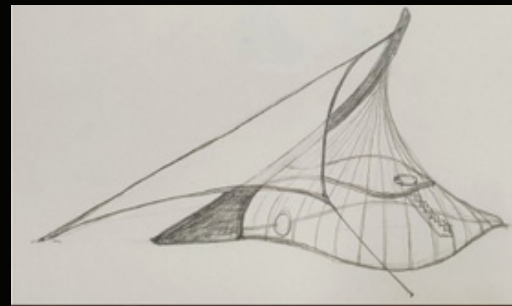
Figure 79_ Transformation process from re-entry Drop Pod to drone. Peters, M. (2022)

> > 4.3.5 PART 5_FIRE DISTRICT

> > 4.3.5.1 FULL DESIGN PROCESS_FIRE

The Fire District in the north of the city shows an environment in stark contrast with the Air District. Where the Air District has an abundance of water and a lush plant life, the north is characterised through dryness and heat in line with the fire trope.

To create shade, the district uses giant shade cloths made from mycelium grown in the coolness of the Spirit greenhouses.



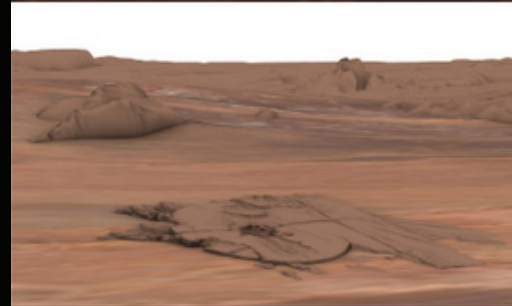
1. Original sketch



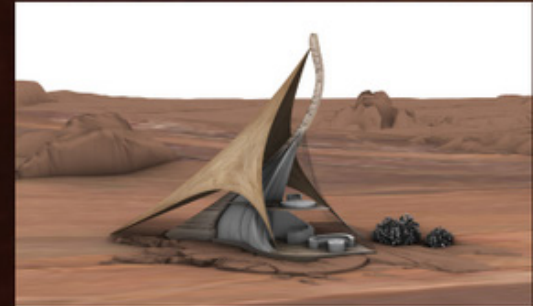
2. Basic 3d sketch in Rhinoceros

3. Adding organic elements in VR Gravity Sketch.
Changing design based on 3d experience of space

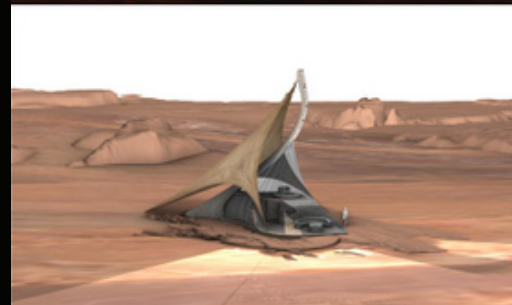
4. Modelling in Rhinoceros, adding textures and details



5. Base landscape design in Rhino



6. More detailing in Rhino



7. Basic lighting in Rhino



8. Adding elements and atmosphere in Photoshop

Figure 80 - 87_ Design process fire district. Peters, M. (2022)

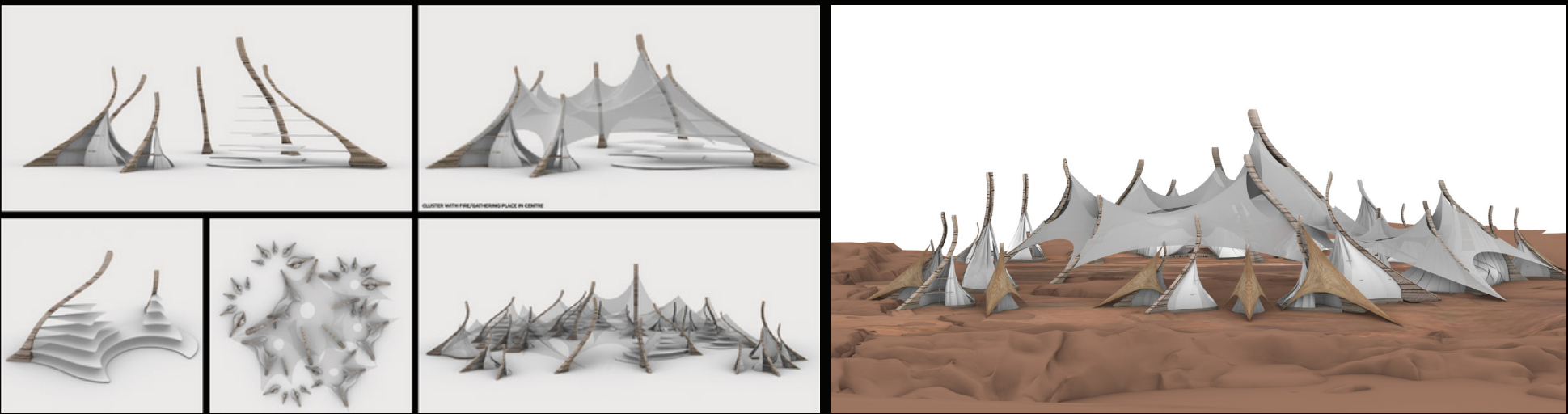


Figure 88 - 93_ 3d modeling process fire. Peters, M. (2022)



Figure 94_ Fire district work in progress. Peters, M. (2022)



> 5. CONCLUSION AND TRAJECTORY

The initial aim of the project was to investigate the question:

HOW CAN WE AS CONCEPT DESIGNERS HELP BROADEN AN AUDIENCE'S PERSPECTIVE ON NATURE-INSPIRED ARCHITECTURE AND URBAN DESIGN?

I believe that the proof of concept animation successfully demonstrates my vision of how this question can be answered: Drawing on the research into effective tools for edutainment, and learning from Jules Verne's example, it was clear that it would have to be a combination of engaging storytelling and cinematic awe-inspiring scenes to draw the audience in, mixed with factual information to educate about the topics at hand.

I consider the VR format to be the best way to combine those elements. While developing the full VR animation, including 3d modelling, sound, and lighting, required considerably more time and effort than conventional concept designs, I do believe that including those aspects in this proof of concept is key to create the intended emotional impact and immersiveness of the final piece.

Referencing a myth that the majority of the audience is already familiar with, like the story of Atlantis, helps to make the storyline easily accessible. Setting it in the future and in a dystopian context gives it a new perspective, which I believe helps to raise the audience's interest.

Furthermore I think that VR is the best choice to portray the project's world and architectural designs. VR allows for flythroughs and the experience of some of the buildings and environments at full scale, which helps successfully convey the intended sense of awe and shape language to draw the user in and to communicate the biophilic and biomimetic designs.

However, I think that the education aspect in this proof of concept is heavily reliant on the infographics, and that realising a final version with a larger team would enable also incorporating interactive elements. This would allow the user to actively participate and would add a new layer to the learning process.

As VR headsets are becoming more and more common in ordinary households, a wider distribution of a final VR experience directly to private users is also a possibility, thus surpassing the current intent to exhibit in exhibitions and at universities.

In particular two elements of this project have greatly influenced my approach to set design:

1. exploring biomimicry and biophilia in the context of architecture, and
2. studying the psychological impact of architecture through the lens of psychogeography. This, in combination with upskilling in the software pipeline of taking designs through the 3d modelling process all the way into VR, has paved the way for me to enter the metaverse industry as a creative.

I look forward to introducing biophilic design into the fledgling metaverse space, hopeful to eventually be able to play a small part in creating a virtual environment, which will feel as smidgen as extraordinary as Gaudí's Sagrada Família.



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> 9. APPENDICES



ICON DESIGN FOR DIFFERENT ASPECTS OF CITY

1. ENVIRONMENT



2. CITY | SOCIETY



3. DISTRICTS



4. INDUSTRY | INSTITUTIONS



5. COMMUNITIES



6. HOME | FAMILY



"ATLAANTIS" CITY | Universal laws

1. ENVIRONMENT

- Former uninhabitable earth due to weakened eart magnetic field,
no protection from solar radiation
- Now magnetic field stabilised
- Intense/enlarged sun
- At times large Auroras on the horizon
- Environment and remnants of former civilisation scorched by
century long exposure to radiation
- Very dry climate
- Clear most days, good visibility
- Occasional sandstorms - yellowish dust, obstructing view of
mountains, strong atmospheric effect in city
- Sandy, Rocky terrain
- Former Ocean floor, water absorbed by rock through cessation
of tectonic movement (see more detail under ...xx)
- Water stored in underground aquifers
- Vast mountain range surrounding city
- extreme temperatures, cold by night, hot by day
- Located close to aquator, no change in seasons
- Dust/Sand encroaching on the city



"ATLAANTIS" CITY | Universal laws

2. CITY | SOCIETY

3a. GENERAL

- Ca 400 k population, based on size of Wellington City including Hutt Valley and Porirua - voted most liveable city in 2018 by deutsche bank, one deciding factor was the length of daily commutes.
- Build on left over foundations from Atlantis - jagged, rocky in start contrast with smooth, organic, bio mimetic design
- Build of city started in center of circular layout, evolving outwards, in the concept art ca 1/3 of city has been build, second third is building work in progress, last third (outermost area) still untouched
- So far city inhabited by ca 400 k people (comparable to population of Wellington city incl. Hutt valley and Porirua)
- Water is being collected from air with help of dew collectors
- All energy is solar, fields of futuristic looking solar panels lining outskirts of city
- Concentric layout, in line with Plato's original description of Atlantis
- Biomimetic style language in all aspects
- One coherent style for whole city, e.g. inspired by root system or light patterns (metaphorical for idealism concept)
- Biomimetic design as tool for optimal efficiency, e.g. optimised connection of places of interest, inspired by "slime mold" approach. <https://www.youtube.com/watch?v=GwKuFREOgmo>
- Horizontal society focused on equality, regardless of gender, money, race, represented by inverting the triangular, vertical shape that is typical for large western cities, instead rising up the height of communal, social and educational buildings
- Dissolving of cultural differences - focus on "nature" as cultural back-

ground for all

- Following Plato's original description of the ideal society: moral, spiritual people who lived in a highly advanced, utopian civilization
- Connected with nature, multiple domed natural spaces all throughout city, under glass domes to protect from dust storms, for recreation and agriculture (permaculture)
- Ordered layout of overall city, in contrast with increasing complexity in districts, communities and homes
- Building maximum 5 storeys in community areas to keep city at "human scale", only exception buildings conveying values of ideal society - museums, libraries, festival grounds, spaces to connect to universal spirituality (non religious), but those are build at sloping angle to appear non intimidating.
- City design and concept inspired by Kate Raworth's "donut model"

3b. CENTRAL PUBLIC INSTITUTIONS

/ CIVIC CENTRES

- city hall
- head offices of public departments and services
- public library
- central educational establishments
- Dancing/music clubs
- Markets
- Museums
- Entertainment e.g. theater, cinemas
- Restaurants, cafes - at larger scale

3c. TRANSPORT

- Transport - public only. Transport and infrastructure design inspired by nature, e.g. self accelerating pods along specific "veins" through city, similar to nutrition transport systems in plants
- no parking required
- Foot traffic main focus or futuristic version of bicycles. All necessary amenities able to be reached by foot
- Transport of goods - drones
- Waste system - recycling - as public transport
- Electricity transport? Wires? TBC
- Pipes and wires for distributing water, gas, electricity, etc. Hidden in "veins" of city
- Space ships - external transport means - anchored on outskirts of city



"ATLAANTIS" CITY | Universal laws

3. DISTRICTS

4a. GENERAL

- City divided in 10 districts based on city layout as discribed by Plato
- Distinguished by 10 different bio mimetic designs, potentially similarities between neighboring district pairs, as described by Plato districts were ruled by 5 sets of twins
- Each district is housing approximately 40 k ppl
- minimum one adjacent dome per district for exercise and recreation
- All amenities within walking or "cycling" distance (futuristic equivalent?!), focus to minimize traffic

4b. PUBLIC INSTITUTIONS SERVING LIMITED AREAS (OUTER RING)

- schools
- playgrounds
- Sport / yoga/ swimming, sport fields, gymnasium
- branch libraries
- branch post offices
- police stations
- firestations
- district offices
- neighborhood parks and recreation grounds
- voting places
- public and quasi public halls and social centers
- Supermarkets
- Shops
- Dancing / music clubs
- Retail

- Artisan workshops!
- Smaller markets
- Coworking spaces
- Playgrounds
- Doctors
- Care and rest homes
- Restaurants cafes -smaller scale

4c. CASE STUDY NEUMARKT OBERPFALZ:

40k population

- 16x churches - non centralised
- 8x cinema/theaters - semi centralised
- 1x library - centralised
- 17x educational institutions - non centralised
- 1x main station - centralised
- 3x hospitals - non centralised
- 5x museums semi centralised
- 25x Shops other - centralised
- 4x fire stations - non centralised
- 11x pools and gymnasiums
- 19x supermarkets - non central



4. INDUSTRY | INSTITUTIONS

- Energy generated through solar farms
- Permaculture gardens under glass domes to protect plants from sandstorms
- approx 10.5 m2 per person to sustain life = 4.2 m sqm for the whole city

Materials/Manufacture background:

- Started with limited, small 3d printers - 3d printers printing 3d printers, multiplying and up scaling
 - Large "army" of printers, including climbing - and girder system printers
 - For main structure of city: solar rays bundled as laser to melt sand (silica) to "3d print" glass.
- As tested by Markus Kayser:
<https://inhabitat.com/the-solar-powered-sinter-3d-printer-turns-desert-sand-into-glass/>
- For Districts and homes - customized designs to individualize spaces in a variety of bio mimetic styles

Look of 3d printed silica for construction:

- Different levels of opacity/transparency possible

- Coloration: sand, yellowish -, brown tones at different saturation and opacity levels, all the way to glass clear
- "Layered" 3d printed look, as known from contemporary printing technology
- "Stretched" look, created by robotic arms stretching uncured product

Other colors/materials able to be printed (as described by Plato existing in the area):

- stone in white, black and red
- brass
- tin
- orichalcum
- gold



5. COMMUNITIES

- Small communities up to 150 ppl, familiarity and mutual support.
(Dunbars number)
 - Avoiding anonymity
 - Inclusive
 - Active participation encouraged
 - Interaction with neighbours
 - inclusive - different generations living together
 - Sense of belonging
 - cooperation
 - Every community has all necessary amenities within walking distance - max radius from homebase approximately 2000 m
 - Arranged circular around central gathering place and communal areas
 - Visual Complexity through individual styles of homestructures
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- 150 ppl per community
 - 266x communities per district
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- Many communities have their own permaculture gardens and live mostly self sufficient
-
- minimum one well per community for water supply

6. HOME | FAMILY

- Individually designed homestructures in varying biomimetic styles
 - Personalised
 - Differing sizes based on size of family and needs
 - Average of 4 ppl living together
 - mixed cultures
 - homespaces offering privacy and quiet
-
- Approx 38x homes per community



