VIRTUAL HOME an exploration of virtual space

Virtual Home - an Exploration of Virtual Space

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ABSTRACT

This master thesis examines virtual space, its requirements, functions and considerations. Virtual reality will not only improve the architect's design process, but also the way our physical world is built. Metaverse is referred to as the future of the internet, a virtual world where users will be able to work, play, meet and socialize together in three dimensional spaces.The digitalisation of workplaces is already here and the past two years under the pandemic have forced many kinds of changes across society.
The virtual architecture brought up in this thesis is about virtual architecture that involves the design and creation of virtual space, in terms of functional organization and three dimensional space. Virtual space design becomes relevant for architects as a tool to improve the design process and communicate ideas. Virtual architecture and virtual design and the possibilities of NFTs opens up opportunities for architects to experiment and show their designs virtually, which broadens the field of architecture and architectural design to not only being physical.

The process is defined by research and insight retrieved from it. The initial analysis includes virtual reality and the future of virtual architecture. The design principles for virtual architecture was enhanced by a virtual reality experience, to understand the connection between the virtual and the physical world.

The final result is a design project in the shape of a virtual home that hosts virtual interactive spaces; meeting space, virtual gallery, social interactions and relaxation area. The function serves as a virtual extension of the physical space. Rather than replacing the real-world experiences, the virtual home offers a new way to interact. Improving the digital functions we already use as an answer to the functional needs for virtual spaces today and the demand for architectural design in virtual reality. Referencing familiar objects by using skeuomorphism as a design strategy in the transition from two dimensional screens toward three dimensional spaces, will help users to understand the environment and it opens up access for more users. Environmental psychological strategies become relevant in designing virtual spaces to improve emotions, behavior and understand aesthetic preferences of the users. Virtual spaces today are mostly visually immersive, the level of immersion and interaction of the three dimensional environment can be improved by including more senses in the design.

CONTENT

INDRODUCTION & PURPOSE

The digitalisation is already here, working remotely and interacting with friends online is part of our daily lives. With technology that continues to develop, it is likely that we will spend even more time in virtual spaces in the near future. Virtual worlds aim to temporarily transport consumers to another reality that can transmit emotions, feelings, and sensations. While the technologies develop, so does the architectural process. Virtual reality has the capacity to change how architects and designers create and communicate their ideas long before the structures are even built. This will not only change the way architects work, but also the way our society is built.

What is interesting is how we can create these virtual spaces with knowledge from architectural practices. A practice that is so merged with the idea of constructions and mathematical principles, but also very related to art and design. What is left when we no longer have physical limitations or gravity to rely on? What is it in a space that makes it a space?

“Architects spend an entire life with this unreasonable idea that you can fight against gravity.”

- Renzo Piano

THESIS QUESTIONS

- What would be the functions and requirements for a well-designed virtual space?

- Without any physical limits, what other important considerations would need to be made?

- Are there artificial constraints that are necessary for a virtual space to feel familiar and comfortable?

METHODOLOGY

The work started with research and collections of information and references. A programme of the functions and requirements was used as a foundation for the design process. Sketches were made, by hand and by computer modeling, to investigate options that answered the qualities and functions. The virtual reality headset ‘Oculus Quest 2’ is used for virtual reality experience and understanding of virtual space in general. Rhinoceros and Enscape are used for modeling, renders and VR. Enscape is compatible with the VR headset and gives a quick overview of the project and the space.

DESIGN WORK

The design work of this thesis is an investigation of space through a proposal for a Virtual Home Architecture Competition. The competition was announced by the international competition organizer Bee Breeders. The Virtual Home competition raised interesting questions about architecture design, space, environmental psychology, and the future of the architecture process. The abstract building programme left room for personal interpretations and investigations.

PART I Virtual Reality

VIRTUAL REALITY & AUGMENTED REALITY

Research into virtual reality has been going on for many years. The first virtual reality head-mounted device (HMD) was developed in 1968, it was large and too heavy to comfortably wear. In 1990 commercial virtual reality devices developed for public access. (Virtual Reality Society 2017).

Virtual Reality is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings (Iberdrola n.d.). The environment is perceived through a virtual reality headset. The illusion of being in the perceived environment is affected by motion sensors that pick up the user's movements and adjust the view on the screen in real time. The user can therefore experience simulated rooms, changing viewpoints and perspectives related to his own head turning and steps (Lowood 2007).

The user can therefore experience simulated rooms, changing viewpoints and perspectives related to his own head turning and steps (Lowood 2007). Besides the virtual headset, there are controllers that allow the user to interact with the virtual environment. The controllers register hand and finger movement through touch sensors.

The main difference between virtual reality (VR) and Augmented Reality (AR) is that VR builds the world in which we immerse ourselves through a specific headset. The experience is fully immersive and everything seen is the environment that is artificially constructed through images, sound, etc. In augmented reality objects are placed as an overlay to the physical world, the real world is the environment and some kind of device is used to simulate the object, a phone for example. (Lowood 2007).

NON-FUNGIBLE TOKEN

A Non fungible token (NFT) is a digital asset that represents real-world objects lika art, music, in-game items and videos. They are bought and sold online with cryptocurrency. NFTs are becoming an increasingly popular way to buy and sell digital artwork. An NFT is unique and interchangeable, with identifying codes, which stands in contrast to most digital creations, which are almost infinite in supply. Like any art in the physical world, cutting off the supply will raise the value of a given asset. (Conti & Schmidt 2022).

Over the last few years, NFTs entered the realm of architecture and design and started conversations about its role in the future of the digital economy (Cutieru 2022). NFTs have a big implication for the future of digitalization and commoditization of the unbuilt environment. With the technologies and creation of virtual worlds it is possible to collect art. NFTs are believed to be the next step in fine art collecting and redefines how we place value and display art. (Overstreet 2021)

METAVERSE

Metaverse is defined as a network of three dimensional virtual worlds which aim to create social connections with virtual reality and augmented reality. The technology behind virtual reality and augmented reality has progressed rapidly, and there will be a shift in how we interact with technology and social media. Metaverse is a location and investors are paying millions for virtual land, just like property in the real world. They invest, build and make it interactive. In the virtual world, people can interact as avatars, they can go to carnivals, music concerts and museums. (DiLella & Day 2022).

VIRTUAL ARCHITECTURE

While much of the virtual reality technology is related to online gaming, there is also a huge potential in how architects design and experience buildings. With virtual reality, architects can create and communicate their ideas. The space can be experienced before it is built and clients can experience the building they have commissioned to understand the project more clearly. Virtual reality can also be used in earlier stages of the architectural process, to explore the relationships between spaces in the conceptual phase. The immersive environment gives a feeling and sense of scale, depth and spatial awareness better than on a screen. (Buildnr 2016)The phenomenon of virtual architecture can have two purposes: a visualization of physical architecture and a functional virtual space.

The visuals of physical architecture are what we are most familiar with and are used to visualize, understand and present architectural projects. As the technology developed we have seen a gradual move from drawings on paper to visualizations on a computer screen. The virtual architecture brought up in this thesis is about virtual architecture that involves the design and creation of virtual space, in terms of functional organization and three dimensional representation. Architects design structures to provide places for people to live, work, play and learn in. The concept of virtual architecture is to provide a virtual space for people to socialize, work and learn and play in.

VIRTUAL REALITY IN THERAPY

With virtual reality it is possible to mentally transport somewhere else, and this could be powerfully used for simulations of scenarios where psychological difficulties occur. There is a huge increase in the use of virtual reality in the healthcare sector where VR is being used in medical training, patient treatment, medical marketing and disease awareness to train and support healthcare professionals to heal patients. Scenarios that we only can imagine can be experienced within virtual reality to support mental and psychological health in therapy (Visualise n.d). Virtual reality allows patients to be totally immersed in an environment, and this sense of immersion can lead to changes in the way the brain processes the body.

A study by the University of Washington showed that virtual reality could help patients undergoing physical therapy after a skin graft acted as a distraction and reduced pain levels for the patients. Virtual reality for physical therapy has been shown to speed up recovery time. (Visualise n.d). This proves that by being mentally somewhere else, virtual reality can impact our brain and the way our body responds to it.

THE DIGITALISATION OF WORK

We are facing a technological revolution that will fundamentally alter the way we live, work and interact with each other (Schwab 2016). The digitalisation of workplaces are already here and the past two years under the pandemic have forced many kinds of changes across society. Remote work, remote learning, online shopping, and a larger focus on health and well-being. Aspects that are now a fundamental part of our daily lives. (Dickinson 2022).

The concept of work and workplace are being separated. Digital devices are essential to running a business, office workers can access the information they need at any time of the day and teams can collaborate in projects from across the world. Parents can more easily work from home than before. (Urban hub 2017). While the traditional workflow is changing, so are the work place and meeting rooms. Offices are being redesigned for flexibility, and more digital screens are implemented in the offices.

There will be more focus on the screen than on the conference table. As technology becomes the present element in business meetings, the connection between virtual and in-person participants and the sound quality will be more important. (Quito 2022).

The Covid pandemic was followed by a rapid rise of video conferencing and almost everyone is now familiar with the digital meeting. The digital meeting room is an aging technology and there are a lot of limitations to it. Virtual reality development can therefore add value to meetings and communication in the future. A virtual meeting is like a traditional meeting except it is remotely. All participants that are using a virtual reality headset can be transported into a virtual office for the meeting. The meeting can then happen in many forms. Instead of each person looking at a screen, the future of meetings will provide everything needed to connect employees in a virtual space. (Program Ace 2021)

THE INDUSTRIAL REVOLUTION

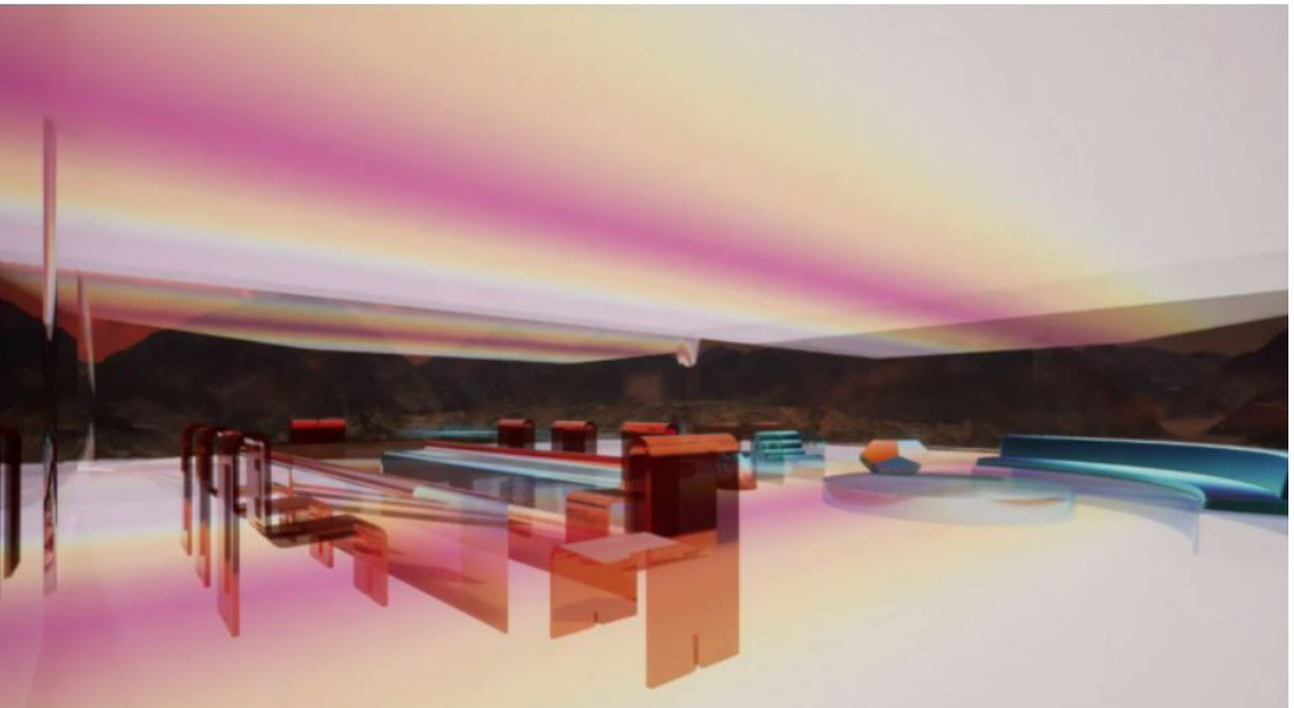


Figure 1, Mars House

MARS HOUSE

Mars House, designed in May 2020 by artist Krista Kim, is the first sold digital NFT home in the world. The house can be experienced in virtual reality or augmented reality. Mars house is the future of NFT and the Metaverse lifestyle. The Mars House set an important precedent by opening the way to a new approach to view the practice of architecture. (Harrouk 2021).

The house is characterized with a futuristic and minimalistic design with glossy see-through interior and a beautiful view. The concept is a design that creates a zen and therapeutic atmosphere (Lean 2021). Krista Kim wanted to create meditativeness and healing through the experience of her digital work. Her art is ment to bring a sense of tranquility in the digital world, where meditation and consciousness is the opposite of technology and the internet.

This is done through colorful lights, art installations and visuals to create symbols of healing and regeneration.This is done through colorful lights, art installations and visuals to create symbols of healing and regeneration. Krista kim translates the traditions of the meditation and spiritual practices into digital, through the power of the NFT into the future.

Krista Kims concept of using screens and colorful lights as something healing and calming is inspiring in the way the digital world, often a stressful space, could be turned into mental wellness instead.

THE MEETING PLACE

The Meeting Place is a virtual meeting space, meant to function as a work and play space in Metaverse. The structure is floating in the air, surrounded by pink concrete textures and a blue sky, meant to feel both familiar and a sense of whimsy. The design is intended to invite collaborations and interactions. The space can be optimized for a variety of uses, hosting a virtual art gallery, developing a coworking space or acting as a meeting room. Users can upload two dimensional images and three dimensional models and interact with them as they would in the physical world. The Meeting place is a vision for what the metaverse can become - a place of beauty and inspiration where the gap between virtual experiences and physical spaces bridges. (Perper 2021).

The meeting place is an example of a virtual space that could function instead of the traditional zoom meeting room on a flat screen, where meetings could be in a creative environment, even if the work is remote.

HORTENSIA CHAIR

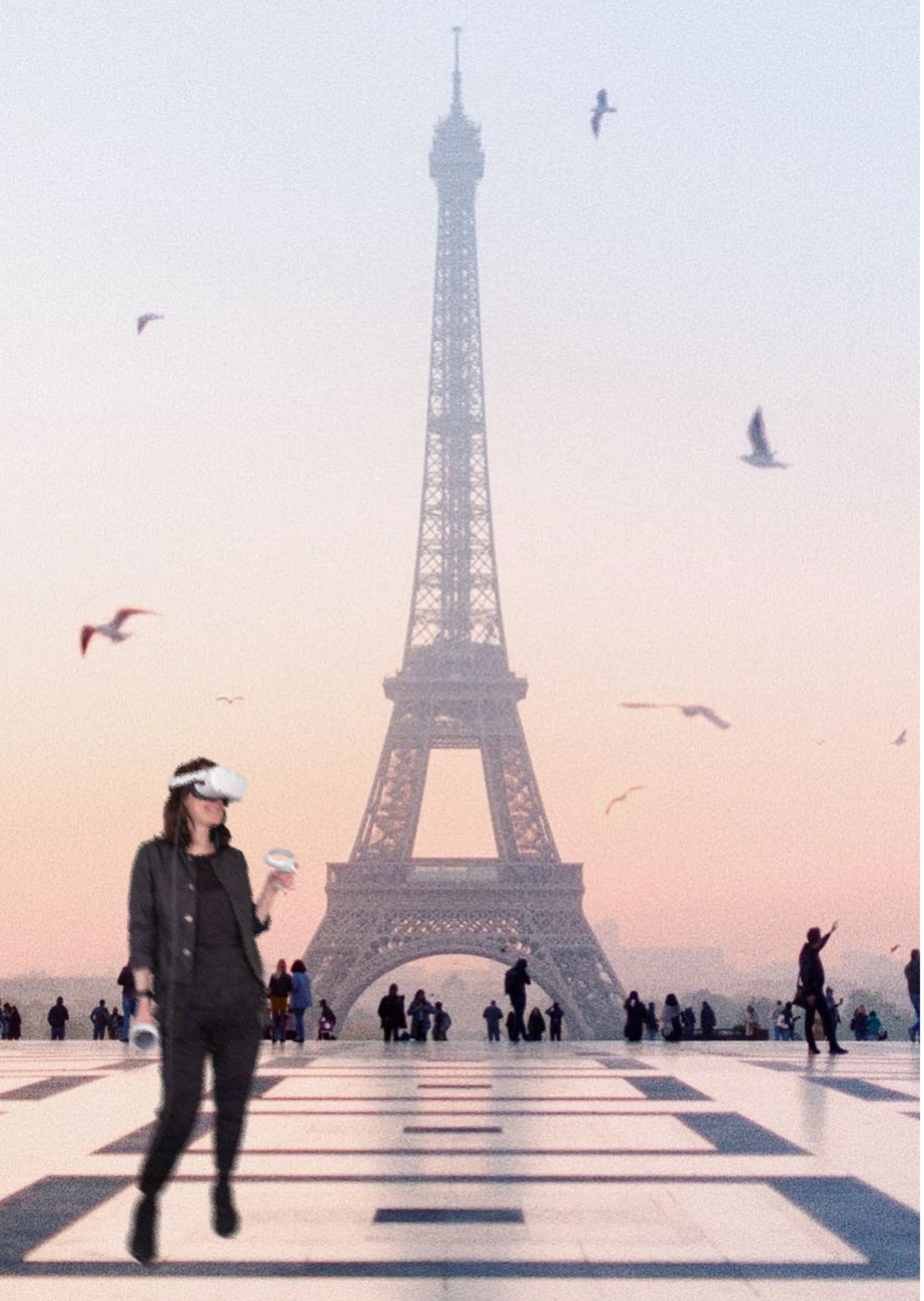
Andrés Reisinger has sold multiple pieces of virtual, NFT, furniture of the most expensive non-existing items. Each of the virtual items can be placed in any shared 3D virtual space or Metaverse. The Hortensia Chair is one of Reisinger's designs that went viral on social media, was shared multiple times and got thousands of likes. The chair was featured in famous design magazines and the studio got contacted by customers asking for an order of furniture that did not physically exist. In 2019 the Hortensia Chair became a real product. (Hahn 2021).

The Hortensia chair is an example of where the unreal engendered the real and where the physical and digital collided. It shows how a visualization inspires the physical world, and not the other way around like we are used to.

Figure 2, The Meeting Place

Figure 3, Hortensia Chair

PART II Designing Virtual Space

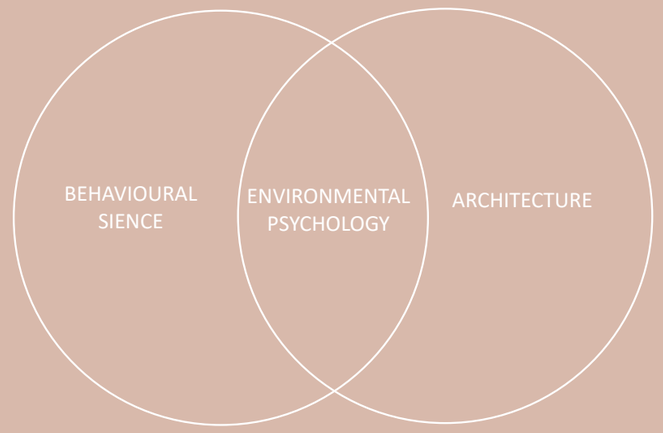


BEING VIRTUAL

By being virtual it is possible to be here and now, but somewhere else, immersed in another world and space. The difference between a three dimensional space and virtual reality is that the user can interact in the virtual environment, move around, explore and change it. Today, we are already connected to the digital world through screens, on the phone or in front of the computer, almost every hour of the day. In most cases these places are designed by a programmer and perceived on screen, rather than a spatial room. With virtual reality these kinds of meeting rooms can be more complex and immersive, a room with spatial qualities instead of a single dialog window. The expanding technology and online activities are having an impact on our social and cultural environment. More online activities will affect our lifestyle and environment and introduce new situations. The intention of the virtual space is to function as an immersive environment for the activities that already exist on our screens today, where we interact with friends and family that are living far away or having a remote work meeting from home, but in a more inspiring environment. Instead of spending hours shopping on a screen, the shopping experience could be much more entertaining.

VIRTUAL DEISGN

When designing a virtual space, the aim is to design it in the virtual worldwith the purpose that it will probably never get built in the physical world, but that doesn't mean it won't be experienced. The design principles for virtual architecture include the representation and characterisation of the relation between the function and the visualization of the form of the virtual place. Virtual design is for virtual users and virtual architecture draws knowledge from architectural design. The geometric description of the space will not be an answer of physical needs or extents, but an answer of a function where the design process will focus on providing functionality. The functional aspects of physical architecture can therefore influence the design of virtual worlds. Elements in a virtual world are optional and free from physical constraints and limitations of gravity. The function of for example a physical roof and walls is to protect from the weather and keep a certain temperature. In a virtual world these elements can be used for aesthetic and functional purposes. Walls can define and limit the space, creating an experience and a feeling of being inside while hiding things from the outside.



PSYCHOLOGY OF SPACE

Evidence based design is design that has been scientifically proven and can be reproduced, for example sustainable design that is based on scientific research (Moses n.d). Environmental psychology is the interaction between people and space. Some environmental influences can be seen or touched, but some cannot be seen or touched, but will still influence our behavior and mood. The design strategies used for the space can have a lot of impact on how people feel and behave. (Moses n.d). The environment can make us feel safer or it can create a positive and efficient working place. The interior space has a direct impact on the subconscious, contributing to emotions and perception through specific parts in the brain that reacts to the geometry of the space. It can result in for example, more productivity in an office, higher sales in retail or accelerating recovery in healthcare. (Harrouk, C 2020). When designing in a virtual space the environmental psychology and how a space is perceived becomes interesting and relevant.

SENSORY PERCEPTION

Scientific investigations show that any sensory perception has effects that are symbolic, associative, synesthetic, and emotional. (Gremillion 2019). In the virtual world, the visual sense is in focus while scent is not included at all. Sound can be included and touch is still limited. The visual stimuli is a distance sensor and dominates human perception of space. Hearing and smell is also considered a distance sensor. The other senses, touch and taste, convey information about elements that come in direct contact with the individual. The perception of a space is perceived through all the senses. The visual perception of space is supplemented with the rest of our senses. No single sense is perceived independently of another. Evidence shows that the sensations combine to produce unified perceptual experiences. (Britannica). An environment that considers all of the senses makes us feel more human (Brandhorst 2019). The more senses that can be experienced in the virtual world, the more immersed and real the virtual world will feel.

SKEUOMORPHISM SIMPLIFIED DESIGN

SKEUOMORPHISM

Affordances refer to action possibilities of objects or other features of the environment. The most commonly cited examples of affordances include door handles and push buttons; their physical designs inform users that they can be rotated or pushed. (Interaction Design Foundation n.d). Skeuomorphism can be described as affordance in digital design, a representation of a physical object on a screen. The term is used in graphical user interface design to describe objects that mimic real-world counterparts in how they appear and how the user can interact with them. One example is the trash bin for discarding files on a computer desktop, the object is familiar and the user therefore knows how to use it. Skeuomorphism allows the brain to use those real world metaphors to understand new technology faster. (Interaction Design Foundation n.d). Skeuomorphism has been used by software companies to develop the graphical user interface so users could click buttons and menus, instead of using direct commands or coding. Steve Jobs was using this as a way to help users interact with products more intuitively with the metaphor of the desktop.

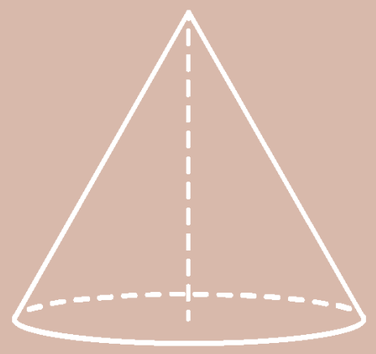
Apple are considered pioneers of digital user experiences, and skeuomorphism is part of it. (Grass 2021). Understanding skeuomorphism lets designers help users through learning curves, make decisions and know how to move and interact with things in the virtual world.

There are arguments that skeuomorphism is not as useful anymore, since users no longer need realistic metaphors to understand the actual function (Grass 2021). If a text or a simplified icon, that needs less work to produce, can communicate the function, skeuomorphism would not be necessary. This argument is based on the learning curve of the technology, that skeuomorphism gets less important the more the user learns the environment. Arguments that speak for skeuomorphism means that humans can never become as accustomed to the digital world as to the physical world. (Interaction Design Foundation n.d). Improving user experiences through aesthetic design by references and associations from the physical world, can therefore be a useful tool when designing in new technologies.

Referencing familiar objects in the rise of new technologies will make new things feel not so out of place. (Shaw 2021). Skeuomorphism makes it accessible for more people to involve in new technologies, including older people and people with not as much technology interest or knowledge. Referencing to familiar objects makes the transition easier and more comfortable. Introducing the user to something completely different from what they are used to will result in frustration, misunderstandings and a lot of mistakes. For some people the step would be too big to even try new technologies. (Prado 2021).

We are in the beginning of Metaverse, a three dimensional world of different projects, standards and communities, which means that a lot of design patterns will emerge. A transition from the screen, toward a more advanced design of a social world and spaces trying to meet the needs of the physical world events and functions. (Shaw 2021). It is hard to imagine what a non-skeuomorphic world would look like. Concepts that are hard to visualize will also be hard to grasp.

Making abstract concepts visual or physical can help to understand them and the rules and concepts behind. In fact, this is what humans do all the time, math and physics are often visualized by drawings of geometrics. Virtual worlds are likely to be very skeuomorphic in the beginning. When people know how to use virtual spaces, there will be much more freedom for new experiences and possibilities. (Prado 2021).



SHAPE & EMOTIONS

Neuroscience and cognitive psychology indicate a connection between shapes of objects and feelings. Human preferences for objects are influenced by many factors including exposure, familiarity, symmetry, contrast, complexity and high fluency. A fluent object will be perceived as more aesthetically positive, which explains why symmetric shapes with less information are prefered before asymmetric shapes. Studies in how variations of contour lines impact aesthetic judgements and approach avoidance decisions resulted in that curvilinear spaces were perceived as more aesthetically beautiful than rectilinear spaces. (Grobman & Shemesh 2015).

The general objective aesthetic experiences result from three fundamentals: perception, cognition and emotion. The mechanics behind aesthetic experiences are universal among human observers, because they relate to common processes and perceptual features, like complexity, symmetry, proportion and contrast. (Stanischewski et al., 2020.) Understanding and predicting human aesthetic preferences is useful in creating more pleasant design and environments. Squares, circles and triangles are geometric shapes that are familiar and common to use in graphic, interior and architecture design. Since shapes attribute different emotions, thoughts and perceptions the brain, it is possible to influence how people feel about a design by choosing the shapes which provoke a certain response (Ayudhia 2020).

Squares and rectangles are the most common shapes in design and layouts. The straight lines and angles give a sense of reliability and make people feel safe. Squares and rectangles are perceived as less interesting, but can be more interesting with shading or other effects considered in the design. (Ayudhia 2020). Triangles are defined as dynamic and will bring a feeling of stability and balance to the design. The design of a triangle can show direction and motion depending on how the triangle and the top is placed. (Ayudhia 2020).

Circles, ovals and ellipses do not have any angles, which makes them feel softer and milder than sharp edges. According to psychological research, round shapes have the ability to improve emotions. The endless round shape will bring a feeling of unity, completeness and ease. By adding round shapes and circles to the interior it can make the space feel more welcoming and approachable, as our brains recognize sharp corners as harmful. Spherical objects communicate balance and are commonly associated with the earth, sun and moon and can help us feel at ease with the surroundings. By adding round shapes and curved edges to the interior, the space will feel more soft. (Slack 2021).

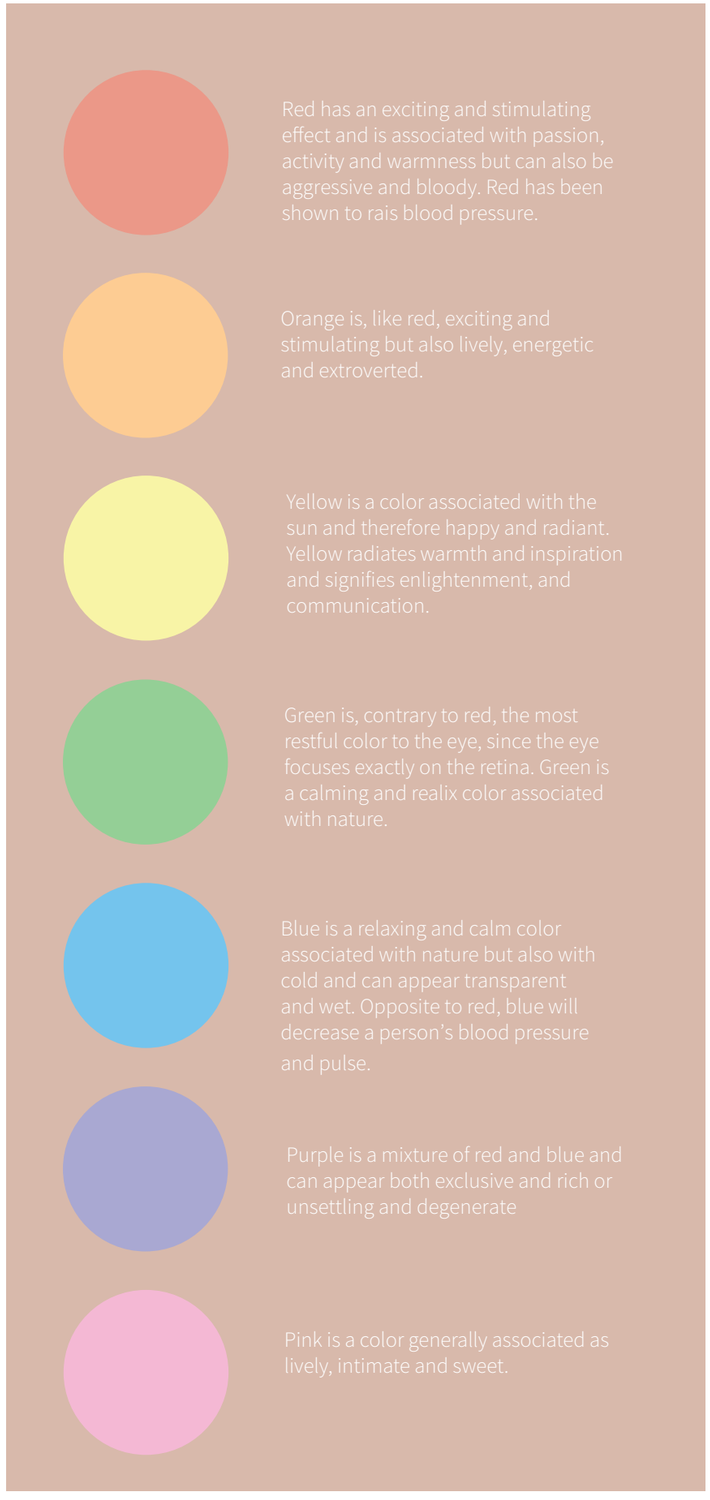
COLORS & EMOTIONS

Color is an element in the natural and architectural environment that play a role in the human evolutionary process. The environment and its colors are perceived in the brain where it processes and judges what it perceives, on both objective and subjective basis. Aspects of our perceptual judgment processes are psychological influences, communication, information and effects on the psyche. This means that colors in design can be used for more than decorative purposes. Human response to color influences us psychologically and physiologically. (Eis 2017). The impression of a color and the message it brings can be used in creating the psychological mood that supports the function of a space.

Colors and emotions are closely linked and the way different colors can affect emotions depends on a color's brightness, shade, tint or tone and whether it's cool or warm toned (Gremillion 2019). Warm colors often evoke feelings of happiness, optimism and energy. Cool colors are usually calming and soothing (Brandhorst 2019). The color of a space can impact our moods and thoughts in many ways. Depending on age, gender, ethnic background and climate, we can have different associations with different colors. Certain colors are shown to receive a common reaction from most people though. The eye has to adjust to focus on red since the natural focal point of the color lies behind the retina and therefore appears closer than it is. An intense color like red has been shown to raise blood pressure and will raise a room's energy levels (Borrelli 2022). Red is often associated with passion, activity and warmness but can also be associated as aggressive and bloody. (Eis 2017). Green is a color associated with nature and is, contrary to red, the most restful color to the eye. The eye focuses exactly on the retina when viewing green, and will lower the blood pressure and slow down the heart rate. The calming and stress relieving effect of green is useful for setting a more relaxed mood. Orange is an energetic color that evokes excitement, enthusiasm and promotes activity. Orange is therefore useful in a room for exercise or play. Yellow is associated with the sun and radiates warmth, happiness and inspiration, and communication. Blue is also a relaxing and calming color associated with nature. Blue can also be associated with cold and can appear transparent and wet. Purple is a mixture of red and blue and can appear both exclusive, sophisticated and rich or unsettling and degenerate. Pink is a color generally associated as lively, intimate and sweet and can boost creativity and are suitable in for example an office. (Borelli 2022) Since the colors can influence both mood and behavior, color psychology could be useful when a certain ambience is desired in a space.

LIGHT

Light has many influences in our everyday lives: biological reactions, subconscious reactions, conscious associations, cultural influences, trends and personal relations (Eis 2017). Natural light exposure is an important factor when it comes to physical architecture. A home will feel more energized and maintain a positive mood if there is access to light. Mood lighting is also important, where lower light in the evening can help to relax and slow down. (Brandhorst 2019). In the virtual environment there is no access to natural sunlight. Artificial sunlight and other light can be simulated according to preferences. Bright light, dimmed light or colored light.



DESIGN QUALITIES FOR WELL-BEING

CONNECTING

- social interaction
- casual encounters/random benches
- homeliness/ familiarity/safety
- unique aesthetics
- nature/landscape

ACTIVE

- exersice spaces
- encourage movement
- nature/outside

MINDFULL

- art, plants, wildlife
- spaces for observations
- open space, landscape
- greenery/nature

LEARNING

- clean/uncluttered spaces
- light/ceiling height
- seatings for interactions/dialog
- art, music

GIVING

- social spaces
- nature/greenery
- all the positivte design qualities

DESIGN & WELL-BEING

Human behavior is strongly influenced by the context and the design of the environment affects our health and can give long term qualities. The definition and study of well-being has been emphasizing the behaviors, where the environment characteristics support positive behavior. (Steemers 2021). Chronic workplace stress and emotional tension can result in burnout syndromes and have been affecting more and more people lately. The symptoms are associated with work life and the environment. Neuroarchitecture is the stimuli that the brain receives from its environment, it demonstrates how the environment can influence human behavior by studying the interactions between the brain and architecture (Ghisleni C). The studies in neuroarchitecture are most focusing on work environments to improve the workplace. Standing desks, versatile furniture, encouraging interactions, natural elements and outdoor areas are some features to improve the workplace. (Steemers 2021). The opportunity for a virtual workplace contributes to making the work less monotonous and allowing for different interactions and environments, which can increase the user's motivation.

Architecture and health has recently established a more holistic awareness of the role of health within architecture. The emphasis has been on ill-health and the direct effect of the environmental characteristics, overcrowding, noice, air quality and light are a few examples. The study of well-being has been emphasizing the indirect effects and environmental characteristics in the built environment that support a positive behavior from people. This science led to the definition of five ways to well-being: connect, keep active, take notice, keep learning and give. (Steemers 2021). Each behavior is associated with subjective positive and mental health and relates to the built and physical environment.

When designing in a virtual world, there are factors from the physical environment that won't be experienced, physical connections and natural sunlight for example. The design of the virtual environment can draw knowledge from, and be influenced by, the built environment and its strategies to achieve similar behaviors within the virtual world, to affect human behavior in the virtual space.

CONNECTING

Social spaces and spaces that connect people and support networks are key to a general well-being. Connection can be through food, nature, light or within conversations with each other. Places with casual encounters, like benches or walkways, create opportunities for people to connect and interact. Other qualities that support connections are spaces without specific or prescribed functions that enable spontaneous activities. The feeling of homeliness and a sense of safety and familiarity, a pleasant, clean and peaceful, or bustling and lively space. A space with unique qualities, aesthetics, or subjective memories and natural, landscape qualities. (Steemers 2021).

The virtual world is another opportunity for people to meet and connect with each other, from all over the world. Virtual public spaces that create opportunities for interactions and discussions is what makes the virtual world a society of connections. One of the differences is that a public virtual space can be accessed from the privat home space, which makes these places easier to access, but also more distant without the physical connection.

ACTIVE

Physical activity outdoors in the natural environment as well as indoor exercise are great for well being. There are design characteristics associated with increasing physical activity, like access to physical activity facilities and pavement walkability. Indoor activities can be equally effective and include strategies like exercise spaces, stair use and distributions of functions to promote movement and circulation over different floor levels and creating attractive experiences along circulation routes through views, art, daylight and greenery (Steemers 2021).

The virtual possibilities of exercises are included in the indoor activities. In the virtual world it is possible to teleport to inspiring environments and arrange shared workouts without leaving the home, as an alternative to home workouts. Virtual cycling is an example where the user is immersed in different environments without leaving the physical spot.

MINDFULL

Being mindful and paying attention to the present and being aware of thoughts and feelings, is a behavior that reduces symptoms of stress, anxiety and depression. Recent evidence shows that art, plantings, seatings and nature increases observations and mindfulness. (Steemers 2021). Being aware of the present moment can take place in many shapes.

With virtual reality it is possible to change the environment and surroundings. Switching focus can be helpful in stressful environments when it is hard to stay focused. Being able to change the environment can be helpful where the possibilities of outdoor and nature are limited but virtual reality is available.

LEARNING

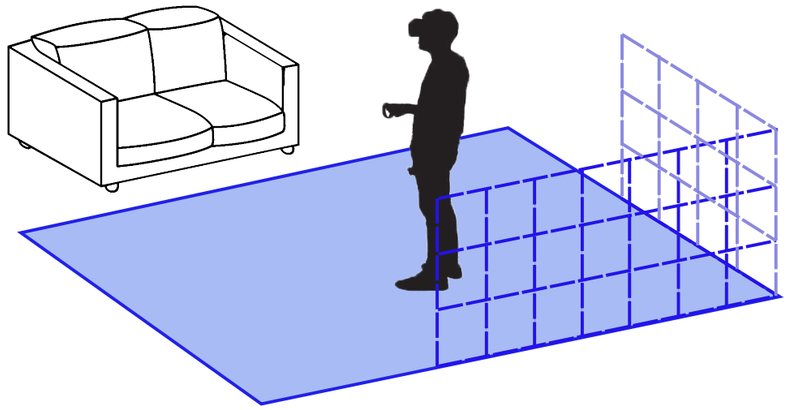
Participations in music, arts and evening classes attain higher subjective well-being. development. The opportunity to engage in art, music, reading and evening classes increase well-being. A clean, light and uncluttered home that is safe for play will influence the intellect and increase well being. The distance and orientation of seating in relation to others will influence the level of interaction and dialogue, a circle of seats where people facing each other will converse more than people adjacent to each other. (Steemers 2021).

The virtual world opens up many opportunities for learning, engaging in activities and participating in discussions with other people. The internet itself is a learning environment. Being immersed in an interactive environment could add extra value to the learning process. When designing virtual environments, the same design strategies can be used, such as clean spaces and seatings that encourage interactions and dialogue.

GIVING

Evidence has emerged that social rather than self-centered behavior has a positive impact on well being. Consequences of unselfish behavior are related to volunteering, offering help and caring about others. A space design that incorporates all the positive environmental and physical characteristics of space design is shown to encourage a more caring behavior. (Steemers 2021).

The five design strategies should be used to create opportunities that improve interactions and mood through form, space and materiality. The result of the five ways to well-being are a set of actions that can be applied in almost any situation, at any age, and which act as useful anchors for a more complex set of definitions (Fletcher 2020).



THE GUARDIAN is set by using the controllers to mark out the level of the floor and track the perimeter of the area within the physical room, where it is possible to move around.

VIRTUAL REALITY STUDY

In the investigation of the virtual space, a virtual reality headset is used to experience the virtual space in order to design it. The main question was to understand how it feels to move around and navigate in virtual space.

There are a lot of different kinds of virtual reality headsets available on the market. For this examination an “Oculus Quest 2” is used. This headset is compatible with room scale virtual reality experience, which means it is compatible to register the physical movement inside of the headset, to allow movement around in the room. There are a few settings and softwares that had to be downloaded and installed before being able to connect the virtual reality headset to the computer. For this thesis project I have been modeling in Rhinoceros and using Enscape as a render and virtual reality program. Besides the Oculus app on both phone and computer, Steam and Steam VR software is required to be installed in order to run Enscape and enable VR mode. There are also specific recommendations for graphic cards that need to be considered for a smooth VR experience with Enscape. The USB port needs to be an USB 3 port. At the moment virtual reality is mostly used for gaming, which explains why these kinds of gaming programs need to be installed. The more demand from architecture practices virtual reality gets, the more softwares will be developed to make the connection more smooth.

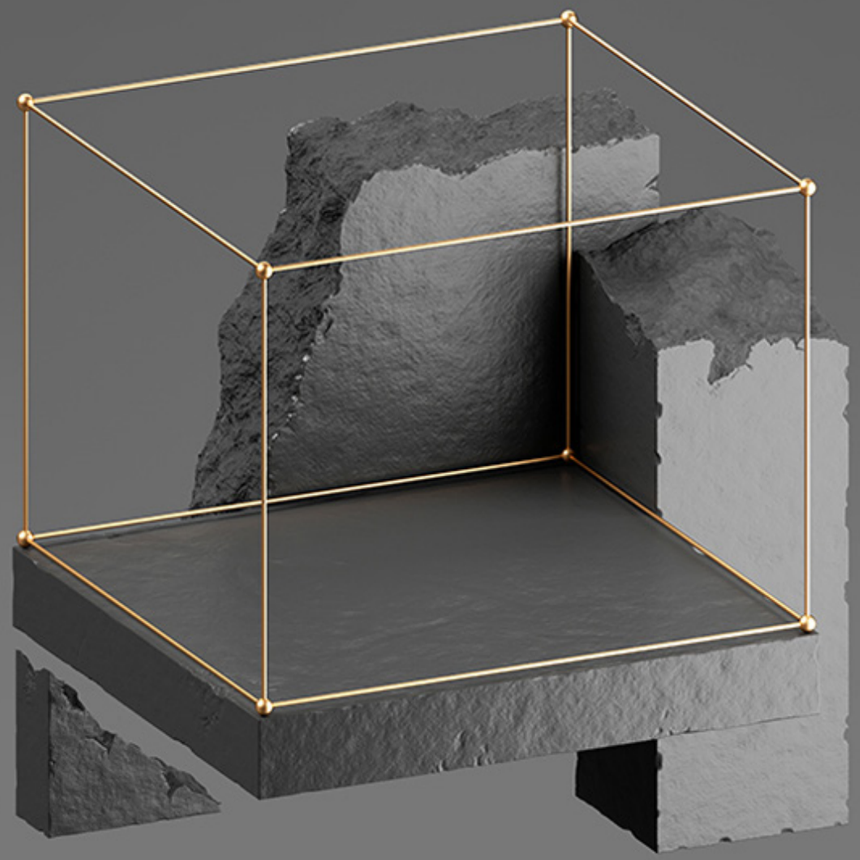
The first thing to do when the virtual reality headset is connected, is to set up a guardian. The guardian is the area connected to the physical room, a boundary area where the headset registers movement and where the user is able to move within. The guardian is set by using the controllers, with touch sensors, to mark out the level of the floor and track/draw out the perimeter of the area within the physical room. It is important that there are no objects within this area to walk into. A clean area, where it is possible to move around. If movement happens outside of the boundary, a gray version of the physical room will appear in the headset.

The experience of trying out a virtual reality headset gave an understanding of how it feels to be immersed in the virtual world and how to connect the physical room to the virtual space. Depending on how large the free space of the physical room is, the play area will be larger. The boundary acts as protection from walking into the walls of the physical room. It is also possible to mark out the level of the floor with the touch sensors. It is possible to move beyond the boundary area by teleporting around in the building. Teleporting is the most convenient way of moving in the virtual world. Walking around too much can cause VR sickness, which is similar to motion sickness. The sickness can be prevented by teleporting most of the time instead. It is also easier and more comfortable to teleport and navigate around than walking around. There are two positions possible, standing or sitting, where the settings can be changed to sitting mode in the VR headset.

PART III Virtual Home Design & Process

COMPETITION BRIEF

The project design in this thesis is an investigation through a proposal for a virtual home architecture competition. The competition was announced by the international competition organizer Bee Breeders. The Competition brief raised questions that became the starting point of the design process in this thesis.



VIRTUAL HOME

The technology behind virtual reality and augmented reality has progressed rapidly, and with Facebook's recent announcement of its plans to further develop the "Metaverse", it's likely that we'll be spending more and more time in virtual spaces in the near future. Virtual work and learning environments are becoming increasingly more complex and interactive, not to mention augmented reality experiences for exercise, entertainment, and gaming. But what about a virtual home? A huge amount of thought, effort, and resources go into making our physical homes comfortable, but what would our homes in the virtual world look and feel like? What would be the function and requirements for a well-designed virtual home? The Virtual Home competition is the first in the Bee Breeders Virtual Architecture competition series focusing on virtual space creation. Architects and designers are being asked to create the concept of a virtual home. Without any physical limits, what other important considerations would need to be made? Are there artificial constraints that are necessary in order for a virtual home to feel familiar and comfortable? In what context would you choose to place your virtual home? Participants are tasked with designing a virtual home, with the main focus being on the design of the living room and work space, but additional functionality can be introduced. (Buildnr 2022).

BUILDING PROGRAMME

Living room (40–50 m2)

Work room
(meeting space for up to 10 people/virtual avatars)

Building context
(where would your virtual home be located?)
Living/meeting space "outdoors" (40–50 m2)

Internal and external circulation
spaces must be explained

**The building programme is flexible, open for modifications and imprived developmen strategies*

Figure 4, Buildnr

VIRTUAL HOME - INTRODUCTION QUESTIONS

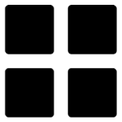
There are considerations that have to be made, and some initial questions need to be answered, in order to design the virtual home.

WHAT IS A VIRTUAL HOME?

The definition of a home could be a private space where one lives permanently, alone or as a family member. The feeling of home is often referred to as pleasant, intimate, safe and secure. A virtual home implies a space in virtual reality. This could be a private space to access any time, that could be experienced alone or shared with other people. A virtual home could be a digital property in Metaverse, owned and utilized by users to connect virtually, a user interface of a digital life experience. The virtual home is a collection of elements in a three dimensional space, where the elements have different purposes and meaning to gain a certain experience. The space is not necessarily limited by the physical laws, but as to reference the real world experience and familiarity some kind of gravity will occur in the virtual space.

WHO IS THE VIRTUAL USER OF THE SPACE?

The virtual space is created with the functions as a foundation, the user is the user of these functions. A virtual space is always changeable, and not fixed and permanent. Like other virtual functions, the possibility of changing backgrounds, adding photos and doing small changes to set the personal touch of identity should be possible to make the place more personalized.



WHAT FUNCTIONS ARE RELEVANT IN A VIRTUAL HOME?

A virtual home has virtual functions. The virtual functions could be related to social gatherings in three dimensional spaces, where the user shows up as avatars of themselves, events, work meetings or vernissages. The function could be related to art collections, creating NFT art, selling or hosting vernissages. The virtual space could be used for self care like exercise, yoga, learning, music and engaging in activities. It could be business related in various scales, selling properties, marketing, owning and renting out, hosting events, designing etc. Functions from physical homes that are less required in a virtual home are sleeping, cooking and sanitation functions.

WHAT IS THE FUNCTION OF A VIRTUAL FURNITURE?

In a physical space we use the furniture in our interior, they function as a place to sit and are often used in different settings to enhance the feeling and identity of the room. In a virtual space the function of the furniture could be seen as a symbol of familiarity, as a place to gather around. It can also function as an interior detail and to set the scale of the space. The furniture and other assets in the home can be collected as NFT art of designers and brands to add value to the home.

WHAT IS THE SCALE OF THE VIRTUAL SPACE?

The scale of the virtual space is relative, there is always a possibility of scaling up and down. The scale will be determined by the surrounding context, building elements, furniture, other users etc. The space can be limited if it is necessary. There is no need for roads or distances between buildings for privacy, the user can teleport between other virtual parts of the Metaverse. The actual limitation of the virtual space is the physical memory, quality and power of the devices.

WHAT IS THE VIRTUAL PLACE AND SITE?

The virtual home is not a result of a physical context, the design is not determined by the circumstances of a specific site. A virtual space is a visual experience, where the design of the space is determined by the skill level and imagination of the creator. A virtual space can be customized, pre-modulated, real-world imitated or mass produced if wanted. Cutting off the supply of any art or creation will raise the value of the asset, therefore the space of the virtual home is meant to be stored and produced as one single unique NFT.

HOW DOES INTERACTIONS WORK?

The users interact with the environment using a virtual headset and a physical space. The headset registers movements of the head and body and sound of the voice, while the controllers register the hands movement and touch sensors. The users interact with each other's avatars by voice, text or video. The user of the home is in charge of the access to their home, invitations of other users can be done through teleportations linked between the virtual environments in Metaverse.

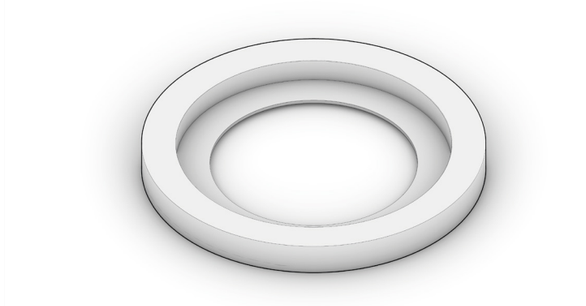
VIRTUAL HOME - CONCEPT

The design of the virtual home serves as a virtual extension of the physical space, in a world where the connection to the digital is a daily part of our lives. Rather than replacing the real-world experiences, the virtual home offers a new way to interact.

The space is brought to life with the different interacting functions of social interactions, remote work meetings, art collections and space for relaxation. A round structure enhances the feeling of movement between the functions, combined with familiar elements and materials to bring a sense of orientation and security.

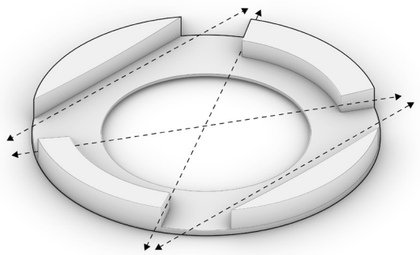
The round shape and curve is continuous through the building and interior to affect the mind positively. The surrounding is meant to bring a sense of peace and awareness. The moon is an out-of-this-world symbol that brings a sense of energy, rhythm of time and anti gravity to the space. By mentally being close to natural elements and the ocean, the feeling of calmness will enhance.

The user can teleport to this place, from wherever they are in the world, to interact with friends and family, in a virtual home.



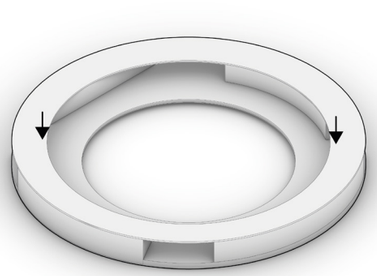
INITIAL VOLUME

The round shape was inspired by the horizontal line to create an infinite shape that enhances the feeling of movement around in the space.



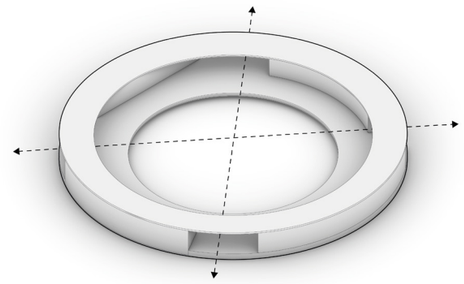
CUT OFF

Four cut offs were made to divide the space into smaller spaces. Four main spaces with void and space for circulation between them.



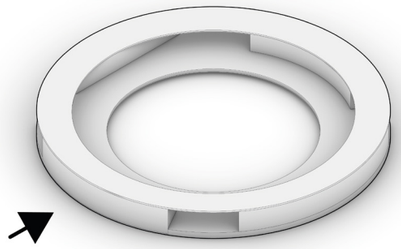
ROOF

A roof is placed on top of the building, for the feeling of protection, safety and security. The roof is slightly tilted to the inside and opens up toward the view of the ocean.



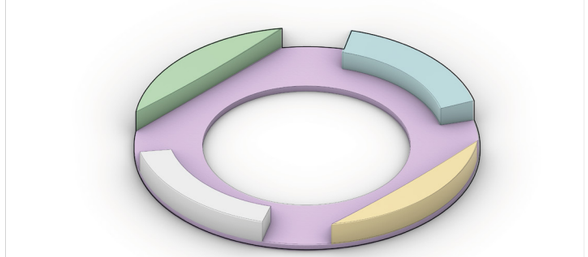
VIEW / AXIALITY

The open structure makes it possible to view all the corners of the building to navigate and to get an overview of the spaces and the different functions. The view and sightline will help in the navigation and orientation between the different functions and activities.



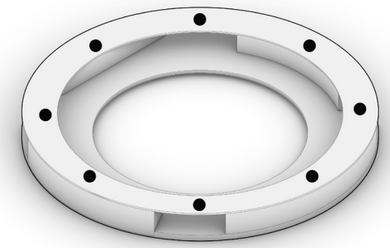
ENTRANCE

The entrance is placed in one of the main spaces to provide as introduction and transition from the physical space.



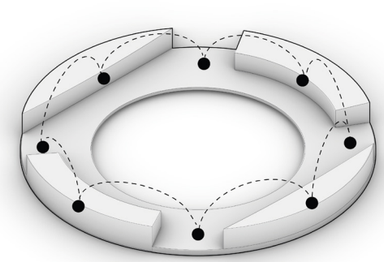
FUNCTIONS

The building is divided into five areas of functions. Entrance, Gallery, meeting, relaxation and social area. The functions that are less required in a virtual home, but required in a physical home, are bedroom and toilet.



ACTIVE NODES

The different functions serve as circulation, or active nodes, where the user can move and teleport between. The feeling of a circulation and movement between and through space will be through teleportation between and within these nodes.



TELEPORTATION

The building is divided into five areas of functions. Entrance, Gallery, meeting, relaxation and social area. The functions that are less required in a virtual home, but required in a physical home, are bedroom and toilet.

FUNCTIONS OF THE VIRTUAL HOME

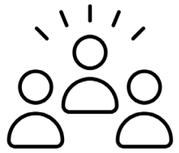
The virtual home consists of five main, interactive functions.

ENTRANCE

The entrance is the first interaction with the virtual home and serves as a transition from the physical world, where you enter and leave, the virtual world.The entrance functions as a sense of onboarding and waiting area, where invited guests are being introduced and led into the building. In the physical world, the entrance and transition into a building is part of the experience of the building.

GALLERY AND ART

Collecting personal items and art is something we do in the physical world to make the space feel more personal and unique. NFTs are believed to be the next thing in fine art collections, the virtual gallery is a space for collecting virtual art and other 3D items, in the virtual home. Having art in the home increases observations and mindfulness. In the gallery it is possible to upload pictures and videos, host gallery vernissages and watch the art. We love to upload pictures and videos on social media to show our friends and family. Personal items in the space bring a sense of identity and give a feeling of home.



SOCIAL CONNECTION

The social area is an extension of our daily conversations on social media. Instead of using a screen, the user can meet up in a virtual space. In the social area, it is possible for the user to interact with friends and family, play games, host parties or hang out and socialize.

WORK MEETINGS

The work area can be used for interactions with colleges, coworking or work meetings. The meeting room serves as an extension of the remote work we are familiar with. By being able to shift workplace when working remotely, the work can be less monotonous and more inspiring.

RELAXATION

The relaxation room is intended to set the user in a calming state of mind, with guided meditations, yoga and relaxing music. The relaxation room is a zen zone, a calming atmosphere for observation, focus and relaxation. Having a relaxation room in the virtual home will serve as a practice from the virtual distraction.

INTERACTIONS

The virtual space is a visually immersive three dimensional environment. The virtual reality headset registers the movements of head and body. The controllers register hand movements and can simulate touch, which makes it possible to move objects, talk to other users and interact within the environment within the restrictions of the equipment. The more senses that can be included in the design, the more immersed the environment will feel. The different interacting functions will make the user feel more immersed.

SPEAK AND TEXT

Speaking using the voice and texting with other users by using the touch controllers

MUSIC

Hearing sound,music, talking, the surrounding sound of the environment

CHANGEABLE

Moving around platforms, NFT art or other objects, uploading images etc, using the touch sensorsof the controllers

LIGHT AND COLOR

Changing colors and light to set the mood and ambience, using the touch sensors

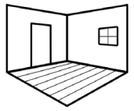
INTERACTIONS

General interactions, meetings, gatherings, games, etc

MOVEMENTS

Movements and navigation around in the environment will be registered by the headset and touch sensors

PHYSICAL EQUPMENT



ROOM SCALE

VR HEADSET

CONTROLLERS

CHAIR

YOGA MAT

NAVIGATION / TELEPORTATION

Physical equipment required for entering the virtual home is a VR headset, controllers and a room where the boundary area can be set. In the relaxation room a yoga mat is required for full experience.

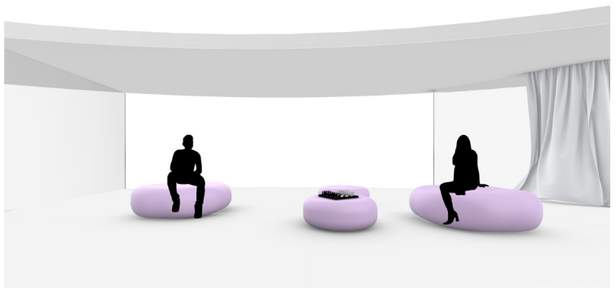
The user will set a boundary area in the physical space that sets the area to walk within the virtual space. The area of the physical room will determine the walking area for the virtual space. The controllers are used for pointing, teleporting, moving, walking and interacting with the environment. The user can teleport freely around to change location within the virtual home. The boundary area will be moved around through teleportation between the different active

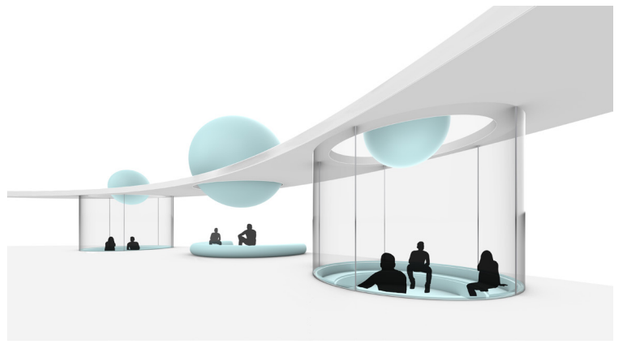
The open structure makes it easy to navigate and to get an overview of the spaces and the different functions. The view and sightline will help in the navigation and orientation between the different active nodes. By using transparent walls, the user is able to teleport and orient to all the corners of the building, without having to move or walk too much.

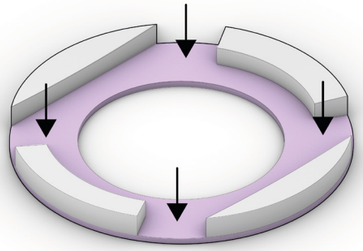
The glass walls are possible to teleport through, while the user would have to walk around a solid wall. The open floor plan with transparent walls gives the user an overlook over the space to easier navigate within and through the space.

While it is possible to walk and teleport freely around in the space, within the set boundary area, some places require sitting mode. In the meeting room and social area, the user will be sitting on a physical chair while entering. In the gallery, entrance and on the rest of the free floor area it is possible for the user to walk around within the boundary area or teleport freely.

The screenshots on following pages will show the navigation from the VR headset perspective to explain the movement through the space. Keep in mind that it is not possible to show the fully immersed experience on a two dimensional screen, it can only be experienced through a VR headset.

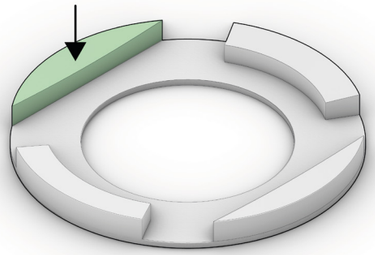






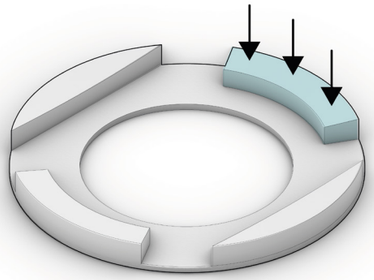
SOCIAL AREA SITTING ZONES

Sitting is required in the furnished parts of the social area. The user will be sitting on a physical chair while entering these places.



RELAX AREA SITTING ZONE

In the relaxation room a yoga mat is required to experience the connection between virtual reality and the physical yoga mat.

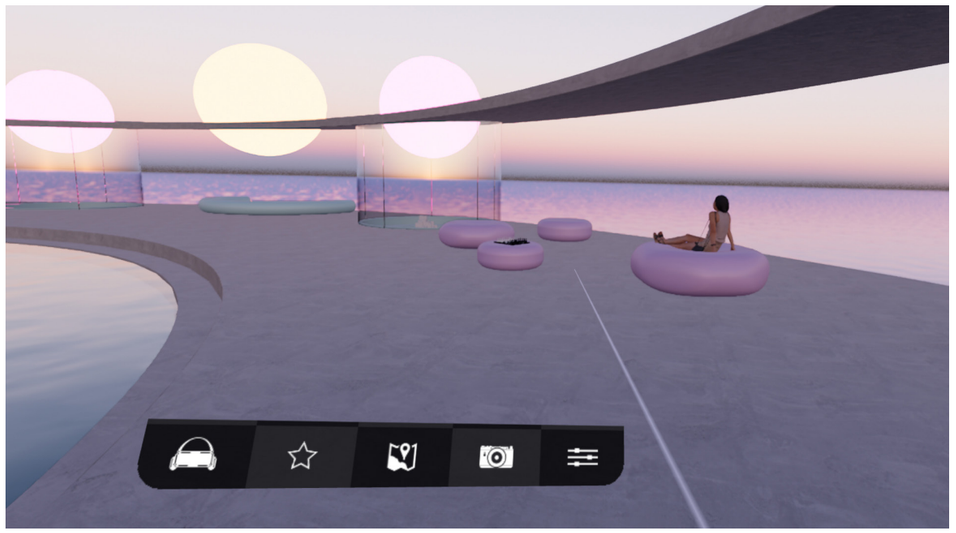


MEETING AREA SITTING ZONES

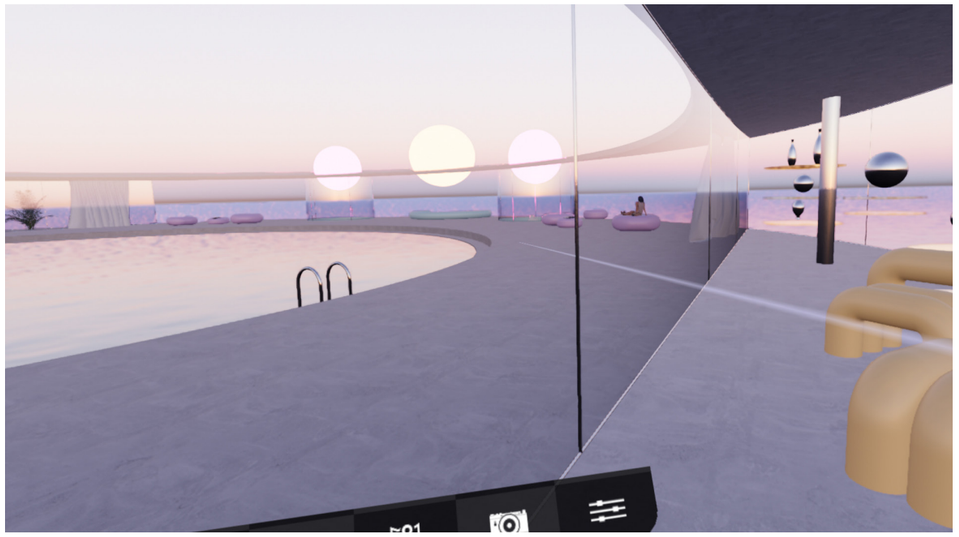
Sitting is required in all the three zones of the meeting area. The user will be sitting on a physical chair while entering these places.

CONTROLLERS The user will be able to view the controllers and a menu when navigating around. The hands/controllers will be shown in VR. The rest of the body is not visible in VR.

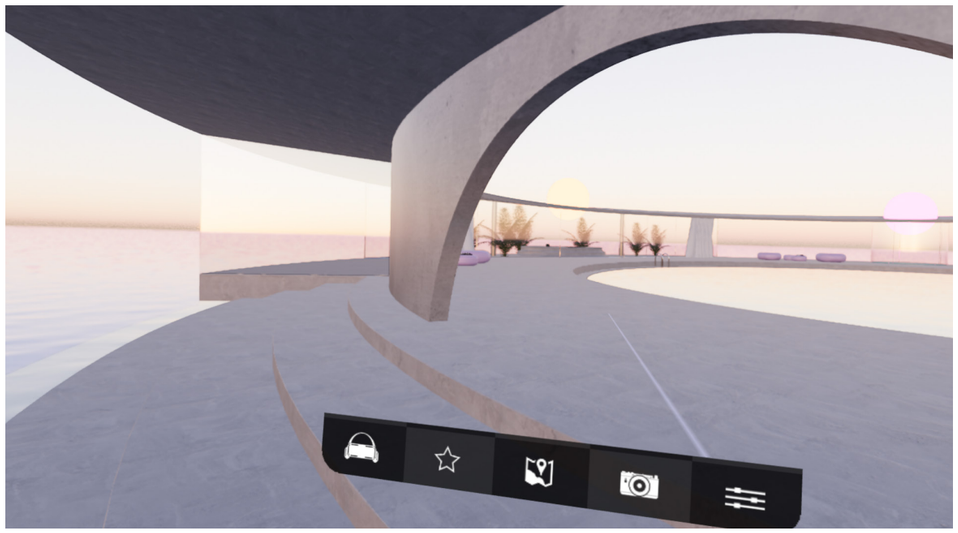
TELEPORTATION The controllers are used for pointing, teleporting, moving, walking and interacting with the environment. The user points at the next location and then presses on the controller to teleport to that location.



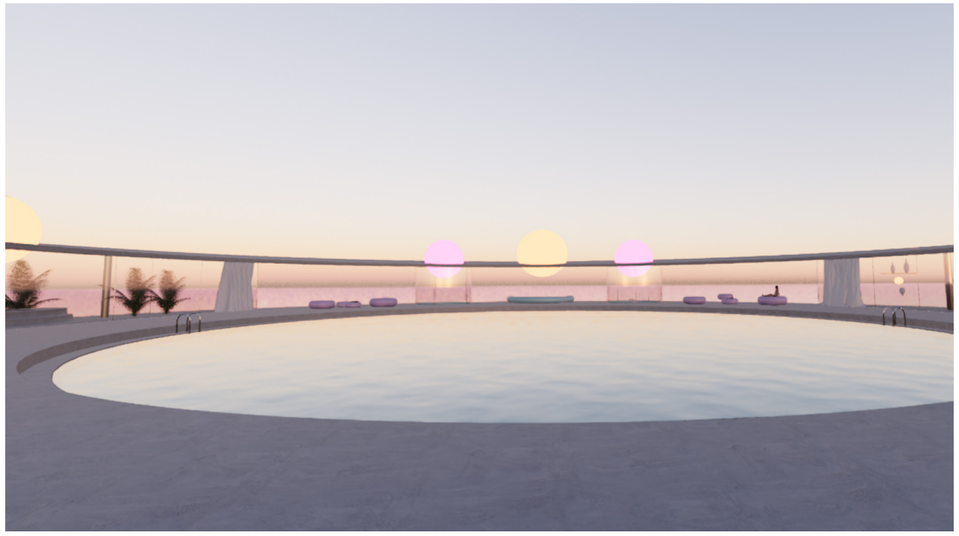
MOVE The user can walk around within the set boundary area of the physical space, and teleport to move beyond the physical boundary area.



OVERVIEW The transparent glass walls are possible to teleport through, a solid wall is not possible to teleport through. The open space with a glass wall gives an overview over the space and makes it easier to navigate around in the building.

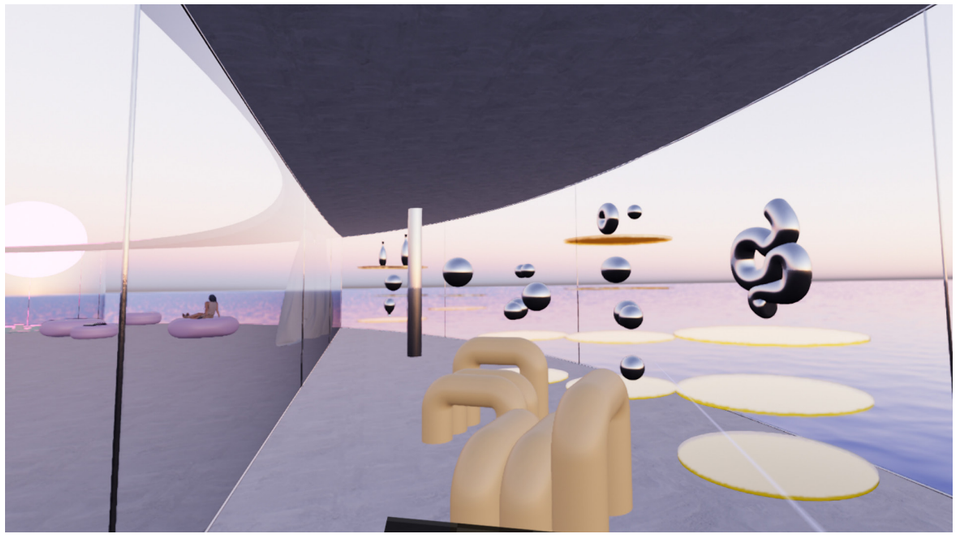


ENTRANCE Waiting area and transition from the entrance area into the building.

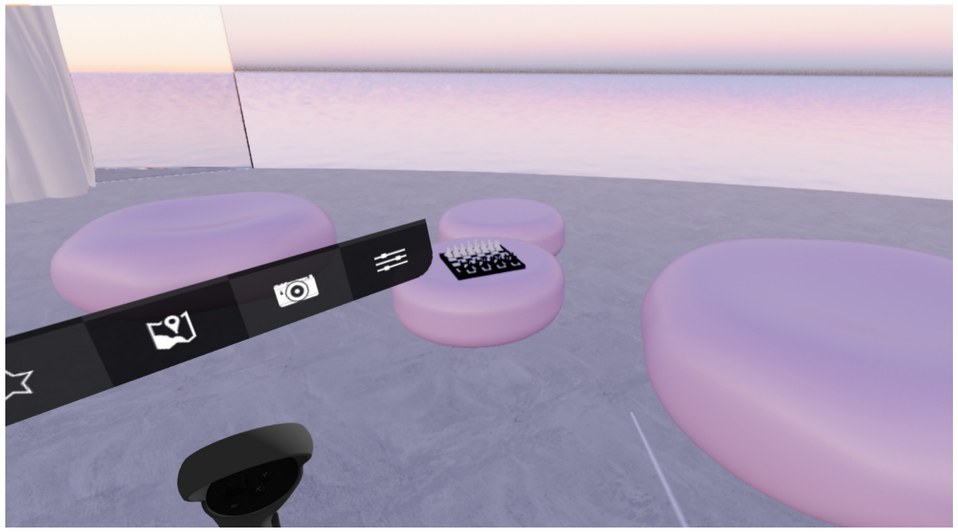


ENTRANCE When entering the building the user gets an overview over the building and functions.

WALK The user can walk around within the boundary area, or teleport around freely.



GALLERY The user can walk around inside the gallery and view the art, place new art and move around the platforms.

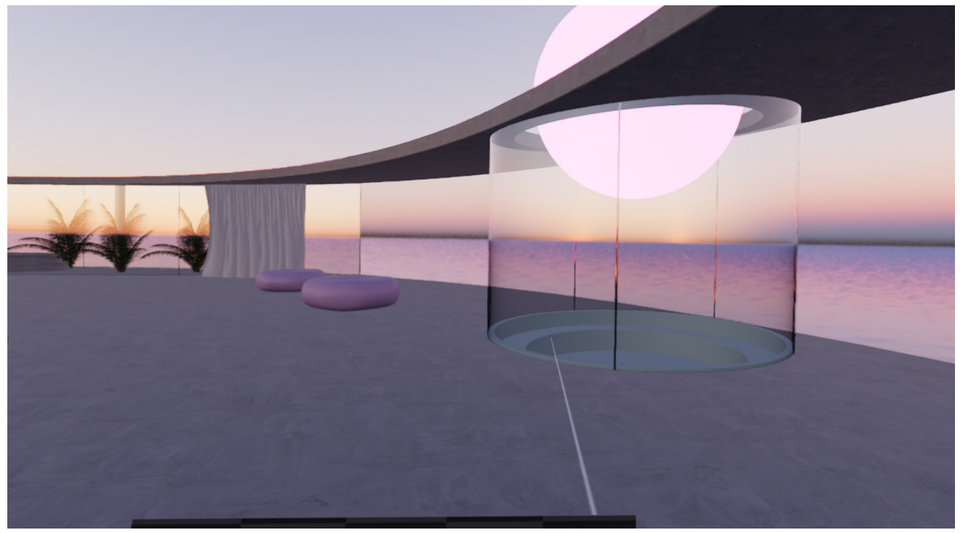


SOCIAL The round interior are symbolizing a sitting zone for gatherings and observations. When navigating to the zone the user will be sitting on a chair in the physical world.

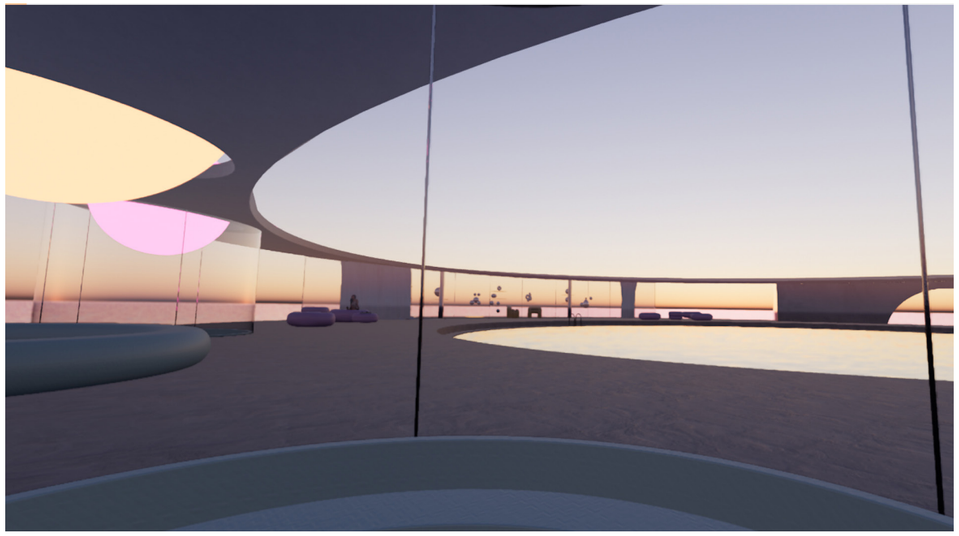
ACTIVE NODES The user can view all the active nodes and navigate directly between them.

RELAX The platform gives a specific place to sit and will lead the focus of the user in one direction.

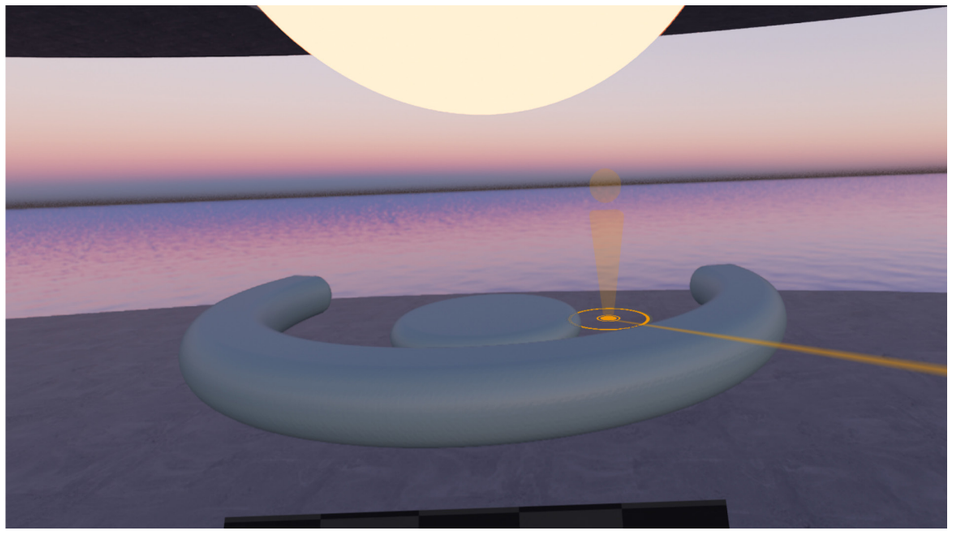
RELAX The relax room is a sitting zone. When teleporting to this area the user will be using a physical yoga mat.



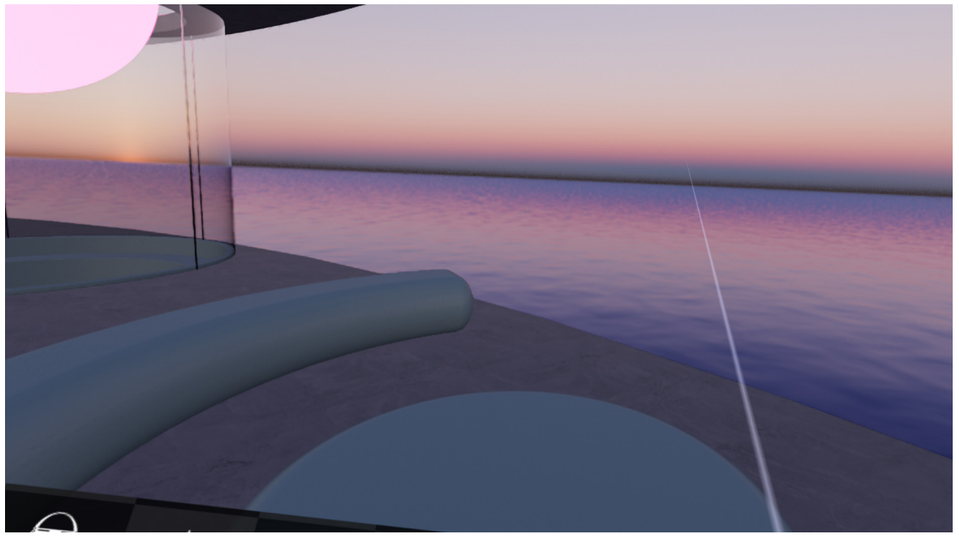
MEETING POD Navigating to one of the meeting pods.



MEETING POD The meeting area is a sitting zone. When navigating to the meeting area, the user will be sitting on a chair in the physical space. The surrounded glass walls give a soundproof feeling.



CASUAL MEETING The middle area for casual meetings is more open and free to walk and teleport to.



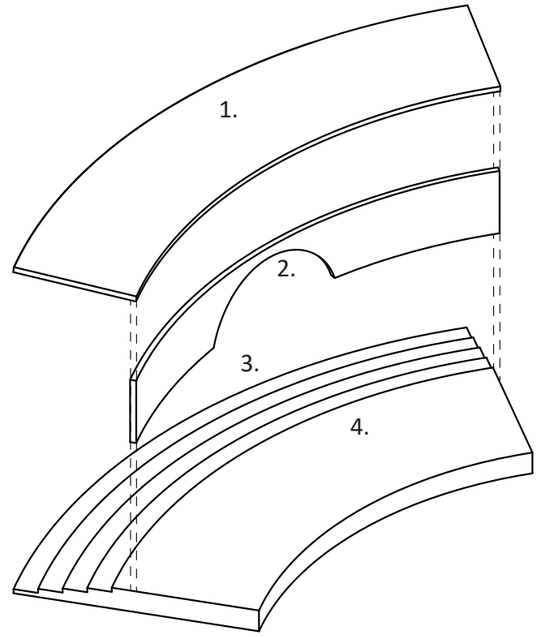
CASUAL MEETING The meeting area is a sitting zone. When navigating to the meeting area, the user will be sitting on a chair in the physical space.

ENTRANCE

In the physical world, the entrance and transition into a building is part of the experience of the building. The entrance will affect how we perceive the rest of the building space. This is what we are familiar with and how we understand entrances. When teleporting around in the virtual world, the transition from one place to another, and from the physical world to the virtual world, can be confusing if the environment is changing too fast or if the contrast is being too big. Referencing familiar objects in the rise of new technologies will make new things feel not so out of place (Shaw 2021). The large opening of the entrance gives a welcoming feeling and enhances a sense of transition that slowly opens up to the view of the building. At the same time it serves as safety and protection of the private home, knowing that not everyone can step into it.

Stairs are often used in front of an entrance as an introduction, and to make the transition to and from the building more smooth. Staircases are familiar elements that lead somewhere and show direction, and we know how to use them from the physical world. Stairs in front of the entrance in the virtual world will bring a feeling of on/offboarding to the building and lead the user in the right direction without needing further instructions.

One of the fundamental factors of architecture is to protect us from the elements, but in virtual spaces there is no rain falling or wind blowing. The roof of the building does not serve as protection from rain or wind, but it will still bring a feeling of protection and safety. We will feel protected by having some kind of shelter over our heads, it is what we are used to and it is how we build our home. The design strategies used for the space can have a lot of impact on how people feel and behave. (Moses n.d). The feeling of homeliness will make us feel safe, the concrete material of the floor and roof will bring a feeling of stability.



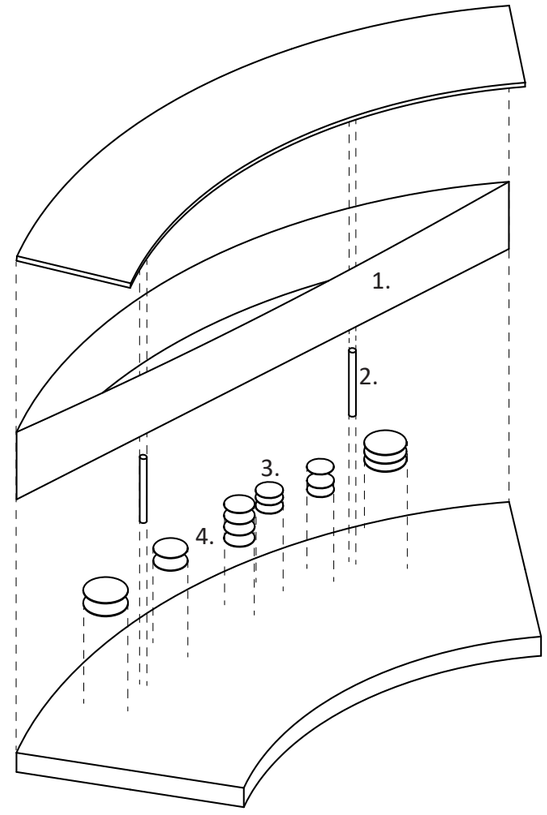
ENTRANCE 1. Roof for a feeling of home and safety **2.** Feeling of transition into the building **3.** Introduction an a sense of onboarding, waiting area **4.** Conrete material for a feeling of stability.

ENTRANCE VIEW

GALLERY

Being aware of the present moment can take place in many shapes. Recent evidence shows that art increases observations and mindfulness (Steemers 2021). We like to give the art a place in our physical homes, hanging paintings on the walls or placing art in the book shelf or on tables. In the physical world we decorate our walls with art of two dimensional paintings. In the virtual world there is no gravity, the art can be three dimensional and float freely around. Walls for hanging art would not have the same function in a virtual world. The floating platforms in the gallery are giving the art a sense of place and order, so that the user can understand how and where to place things. The platforms are movable, the user can interact with the platforms using the touch sensors of the controllers, to decorate with the art and make the space more personal. The user can teleport and walk around within the play area in this space.

The columns will give a feeling of structure, order and stability. The columns divide the space and give some sense of where to place the interior and art. The glass walls frame the space and give a sense of sound proof and security, and makes it possible to view the art from the outside as well as having a view from the inside. The glass walls are also possible to teleport through, which gives the user access to navigate through the walls.



GALLERY 1. Glass wall gives a feeling of frame, sound proof and security **2.** Columns bring a sense of structure, order and stability **3.** Movable platforms for uploading and placing NFT art, photo or videos. **4.** Collections of personal items brings a sense of identity and a feeling of home.

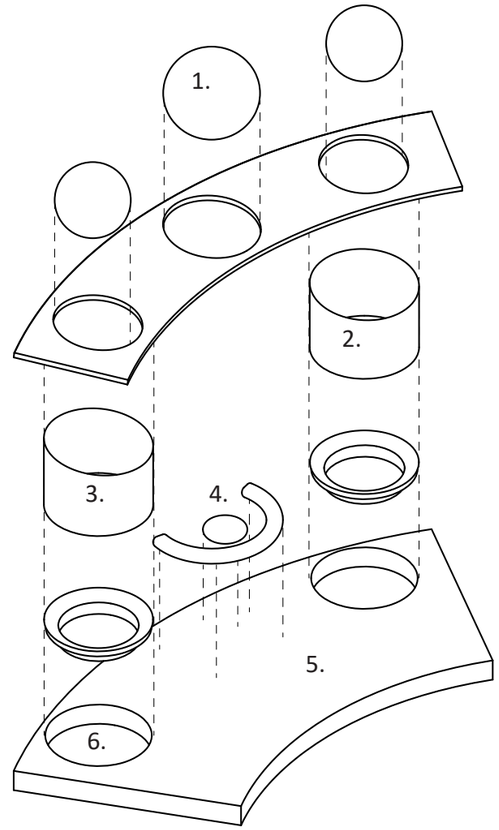
GALLERY VIEW

MEETING ROOM

A virtual meeting is like a traditional meeting except it is remotely. All participants that are using a virtual reality headset can be transported into a virtual office for the meeting. The meeting can then happen in many forms. Instead of each person looking at a screen, the future of meetings will provide everything needed to connect employees in a virtual space. (Program Ace 2021). The studies in neuroarchitecture are most focusing on work environments to improve the workplace. Versatile furniture, encouraging interactions, natural elements and outdoor areas are some features to improve the workplace in the physical environment (Steemers 2021). The opportunity for a virtual workplace contributes in making the work meetings more inspiring and allowing for different interactions and environments, which can increase the user's motivation.

In the work area of the virtual home there are two smaller pods for private meetings and a larger seating area for more casual meetings in the middle. The distance and orientation of seating in relation to others will influence the level of interaction and dialogue, a circle of seats where people facing each other will converse more than people adjacent to each other (Steemers 2021). The arrangement of round seatings encourages interactions and discussions. In the middle of the cirkled seats it is possible to upload three dimensional objects, models or other convenient content needed for the meeting. The glass wall around the smaller pods frames and enhances the sound proof feeling and discretion needed in a smaller, more private, meeting. By having two pods it is possible to divide a larger group into smaller groups. The casual meeting area in the middle fits more users at once and feels more open and surrounded by the environment and the view.

The round shaped light source is floating and bringing light to the meeting space.The color of the light can be changed by the user to bring a different mood setting to the meeting. By being able to change color and brightness, it is possible to change the ambience of the environment, depending on the situation and time of the day. An environment will feel more energized and maintain a positive mood if there is access to light. Pink, and similar colors, have an exciting and stimulating effect suitable in an office or meeting room to enhance activity and creativity (Borelli 2022). Mood lighting is also important, where lower light in the evening can help to relax and slow down (Brandhorst 2019).



MEETING 1. Light source, the color can be changed for different mood settings. The round moon shape brings a feeling of calmness. **2.** Smaller pods for private meetings **3.** Glass wall gives a feeling of frame, sound proof and secureness **4.** Open seating with a view for casual meetings **5.** Round seatings encourages interactions and discussions. **6.** Possibility o upload 3D objects, models, drawings etc.

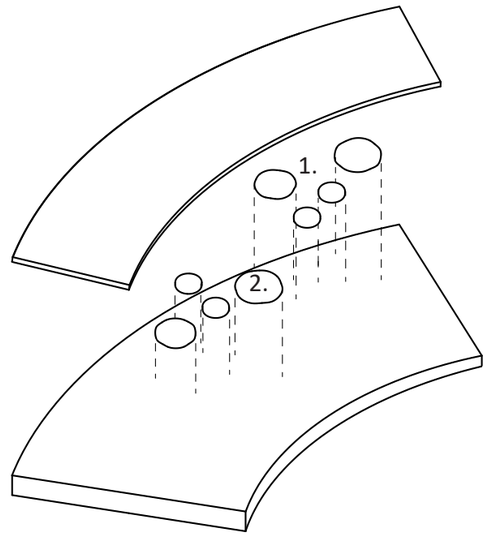
MEETING ROOM POD

SOCIAL AREA

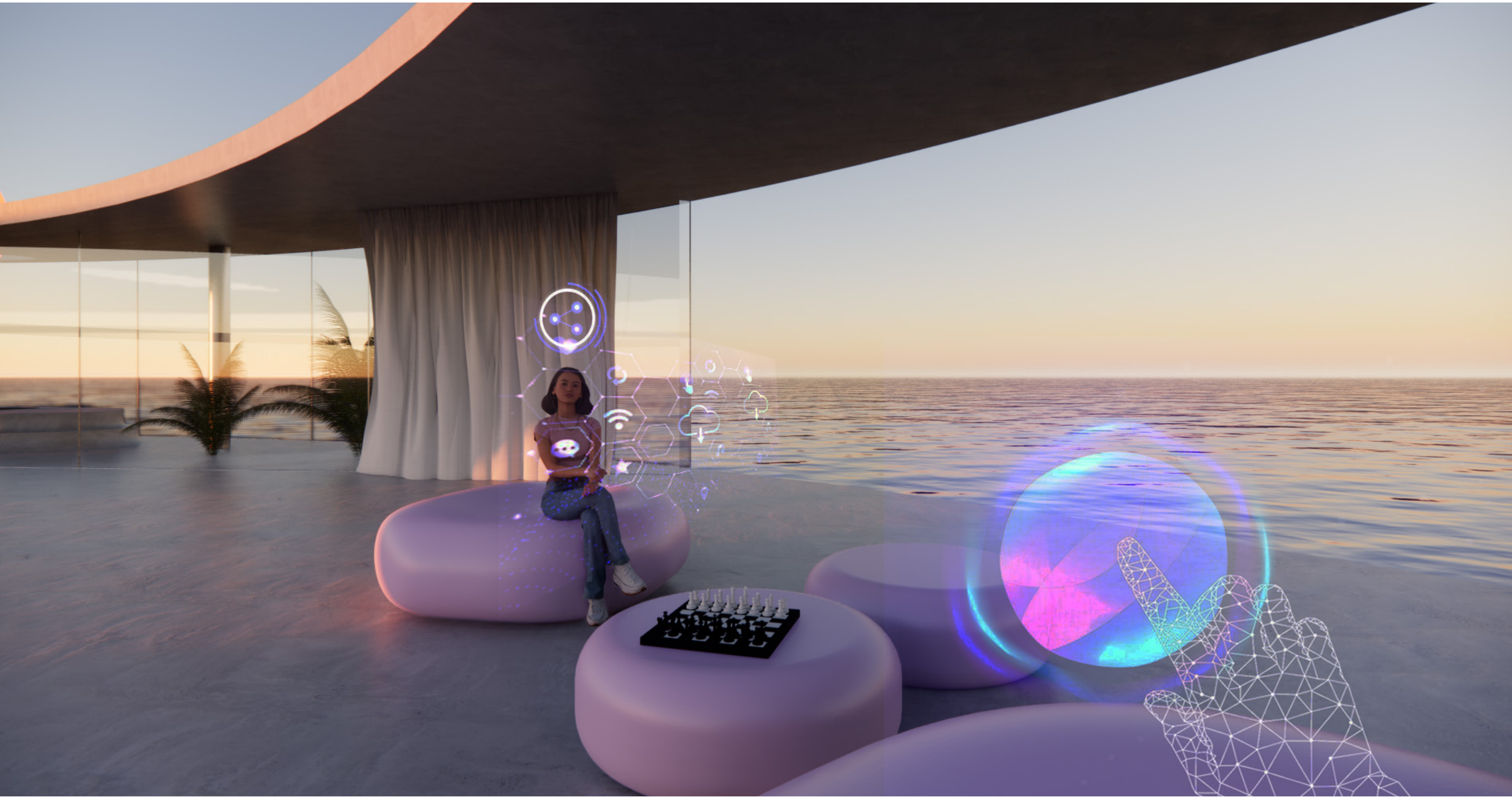
Social spaces and spaces that connect people and support networks are key to a general well-being. Places with casual encounters create opportunities for people to connect and interact. Other qualities that support connections are the feeling of homeliness and a sense of safety and familiarity, a pleasant, clean and peaceful space. A space with unique qualities, aesthetics, or subjective memories and natural, landscape qualities. Recent evidence shows that art, plantings, seatings and nature increases observations and mindfulness. (Steemers 2021)

We are familiar with the idea of seatings and benches as a place to sit, gather and interact. The open social space includes benches and tables that symbolizes and encourages gatherings, discussions and a place to create opportunities for people to interact and learn. The furniture functions as a casual encounter and a place where it is possible to stop for a longer period, meet up with other users or observe the environment. The user will already be physically sitting while entering the social area.

Circles, ovals and ellipses do not have any angles, which makes them feel softer and milder than sharp edges. According to psychological research, round shapes have the ability to improve emotions. The endless round shape will bring a feeling of unity, completeness and ease. By adding round shapes and circles to the interior it can make the space feel more welcoming and approachable, as our brains recognize sharp corners as harmful. (Slack 2021) The round and smooth corners and shape of the interior gives a welcoming and calm feeling to align with the rest of the environment of the virtual home.



SOCIAL 1. Tables and seatings encourage gatherings and discussions. **2.** Smooth corners and shapes of the interior gives a welcoming and calm feeling.



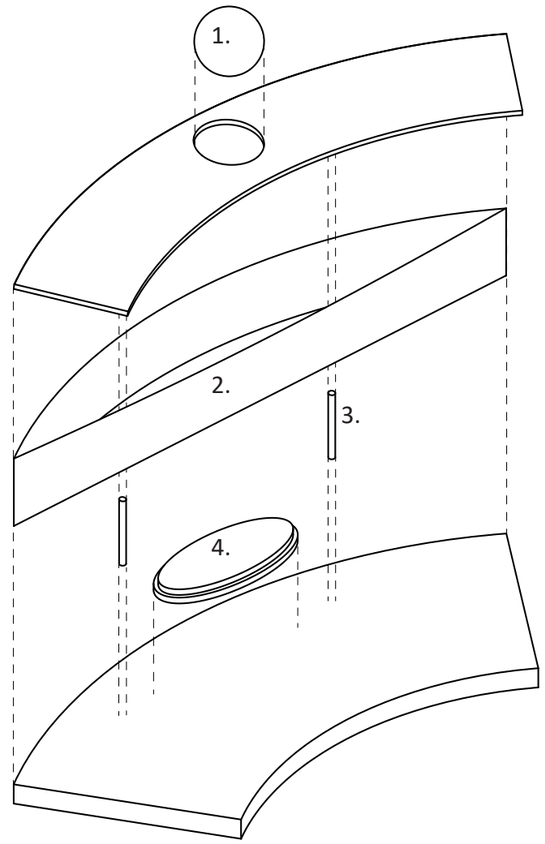
SOCIAL AREA

RELAXATION ROOM

Being mindful and paying attention to the present and being aware of thoughts and feelings, is a behavior that reduces symptoms of stress, anxiety and depression (Steemers 2021).

The structure is built up by glass walls and columns to create a sense of space, the glass brings a sense of sound proof and privacy. The curved platform is placed in the middle and gives a specific place to sit, stability and will lead the focus in one direction. The user can sit on a yoga mat in the physical space to create a more immersive experience of sitting in the virtual world. The floating sphere object in combination with the view of a landscape will make the user feel more at ease with the surrounding. Spherical objects communicate balance and are commonly associated with the earth, sun and moon and can help us feel at ease with the surroundings. By adding round shapes and curved edges to the interior, the space will feel more soft (Slack 2021).

The user is in charge of the sound and can change the color of the lighting to affect the mood and ambience of the space. The calming and stress relieving effect of green is useful for setting a more relaxed mood. When viewing green or blue colors the eye focuses exactly on the retina, and will lower the blood pressure and slow down the heart rate. Orange could be used if an energetic or stimulating effect is desired instead. (Borelli 2022)



RELAXATION **1.** Light source, the color can be changed for different mood settings. The moon shape brings a feeling of calmness. **2.** Feeling of frame, spatiality, sound proof and secureness **3.** Column gives a sense of structure, order and stability **4.** Platform gives a feeling of sitting uplifted, stability and leads the focus.

RELAXATION AREA

REFLECTIONS/ CONCLUSION

This thesis project aimed to examine virtual space, its requirements, functions and considerations. The final result is a design project of a virtual home.

Being virtually connected through a screen is part of most people's daily life, and it is almost a requirement in today's society. Many of the digital functions used today could be improved by three dimensional virtual reality spaces. Improving the digital functions that already exist by making them more inspiring, time efficient, enjoyable or social could be an answer to the functional needs for virtual spaces. The concept of the virtual home design is to offer a new way to interact with the digital environment we know today. Instead of replacing real world experiences, the virtual space functions as an extension of the physical space. The user can attend work meetings from home in a three dimensional virtual context, be mindful and learn new meditation techniques in the relaxation area, select and view art in the virtual gallery, or use the space to invite friends and family for a social gathering.

The design of virtual spaces draws knowledge from physical architectural practices, but with different needs for functions and purposes. The main functions of physical architecture is to protect us from the elements, but in virtual spaces there are no elements to protect us from. When experiencing a building construction in the virtual world, experience from the physical world is used to recognize and understand them. Referencing elements that the user is familiar with will make it easier for the user to navigate around and make decisions. Using skeuomorphism when designing in new technologies is therefore a strategy that will help the user to understand the environment. The structure and material of the virtual home is built up by familiar elements. The concrete floor feels stable, the roof over the head feels secure and the glass walls that frame the different functions bring a sound proofed feeling. Virtual reality technology is under development and there will be a period of transition from the two dimensional screen toward a more advanced technical world of three dimensional spaces. Designing in a virtual world, without any laws or constraints, could result in a confusing environment where things are flying around without any limitations. A space with a concept that is hard to understand from a user perspective, could cause misunderstandings and frustrations. By using design strategies that the user can associate with from the physical world, the transition will be more user friendly and accessible for more people. When people become comfortable with virtual environments, the need for skeuomorphism and metaphors will be less needed. This will likely result in more freedom with the design principles and open up for new possibilities and design strategies in the future.

Virtual spaces can function as a place for people to occupy and it can encourage a certain kind of behavior. The immersion of the virtual environment can lead to changes in the way the human brain processes the body. This is shown in for example physical therapy where virtual reality can speed up the recovery time of patients. Humans can mentally perceive and experience the virtual environment, which can affect both feelings and behavior of people. Using environmental psychological strategies to affect the brain to improve emotions, behavior and aesthetic preferences becomes relevant in designing spaces, both virtually and physically. The interior and environment of the virtual home is intended to enhance positive behaviors for connections and well being. People know that they can sit and gather around a table, the level of interactions and dialogues will increase and be influenced by the orientations of the seating. Certain kinds of colors can positively affect the mood, smooth corners and shapes of the interior are shown to enhance a welcoming and calm feeling and the natural environment increases observations and mindfulness in the human brain. Virtual spaces today are mostly visually immersive, the level of immersion of the space can be enhanced by including more senses in the design. Being able to move around, change and move objects or interact with other users or the environment in different ways, has to do with the human senses, and will affect the users behavior and perception of the environment. The virtual environment is perceived mostly by the visual sense and through headset movements. Touch and hand movements are registered by the controllers and sound can be experienced as well. The visual sense is a distance sensor and dominates the human perception of space, supplemented with the rest of the senses. The visual distance sense is used for orientation and navigation in the virtual environment. Walking around is possible within the set boundary area of the physical space. The boundary area depends on the physical floor area, but this won't affect how far the user can move within the virtual environment. Teleporting around is the most convenient and time efficient option. Moving and navigating around by teleporting will also decrease the risk of being VR sick. By making the virtual home an open space with glass walls that allows a sightline across the building, the user can easily navigate around in the environment using the visual sense as a distance sensor. The glass walls are possible to navigate and teleport through, instead of walking around. By using transparent walls, the user is able to teleport and orient to all the corners of the building, without having to move or walk too much.

Virtual space design becomes relevant for architects as a tool to improve the design process and communicate ideas. Virtual architecture and virtual design and the possibilities of NFTs opens up opportunities for architects to experiment and show their designs virtually, which broadens the field of architecture and architectural design to not only being physical. While technology evolves, so does the architectural process, virtual reality will not only improve the architect's designprocess, but also the way our physical world is built. One of the limitations for this study is the lack of previous research studies on virtual spaces designed by architects. The Metaverse as a phenomenon is in its beginning phase, the future outcome in the society is still unknown. Architects as we know them today are designing virtually for physical spaces and there is a lack of virtual space designs, for virtual users, designed by architects. As architecture moves into Metaverse, both architecture and the role of the architect is being redefined. Most of the virtual interactive designs we know today are designed by programmers and often related to entertainment in virtual games or other fictional designs. This shows the importance of communication and collaboration between architects and other fields of experience. The research of virtual spaces could be further explored by taking study and learning of the rights and wrongs from the gaming world, by recognizing how space and interactions are done in these environments. The psychological research of virtual reality in the healthcare sector used in medical training and patient treatment could be further explored for psychological simulative, cognitive and embodied experiences.

In conclusion, improving the digital functions we already use could be an answer to the functional needs for virtual spaces today and the demand for architectural design in virtual reality. Using skeuomorphism as a design strategy in the transition from two dimensional toward three dimensional spaces, will help the user to understand the environment and open up access for more users. Environmental psychological strategies become relevant in designing virtual spaces to improve emotions, behavior and understand aesthetic preferences of the user. Virtual spaces today are mostly visually immersive, the level of immersion and interaction of the three dimensional environment can be improved by including more senses in the design.

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IMAGES

Figure 1. Dezeen (2021). *This week a virtual house sold for over $500,000.* https://www.dezeen.com/2021/03/27/this-week-virtual-house-sold-mars-nft/ [2022-05-27]

Figure 2. Hypebeast (2021).*This NFT Design Space Allows You To Work and Play in Virtual Reality.* https://hypebeast.com/2021/11/nft-art-installation-the-meeting-place-virtual-reality-metaverse [2022-05-27]

Figure 3. Dezeen (2021) *Andrés Reisinger sells collection of "impossible" virtual furniture for $450,000 at auction. https://www.dezeen.*com/2021/02/23/andres-reisinger-the-shipping-digital-furniture-auction/ [2022-05-27]

Figure 4. Buildnr (2022). *Annual International Architecture Competition Virtual Home edition #1.* https://architecturecompetitions.com/virtualhome/ [2022-05-27]