CZECH TECHNICAL UNIVERSITY
Faculty of Architecture
Department of Design Modelling

Dissertation:

“ARCHITECTURAL AND ARTISTIC SPACES THROUGH VIRTUAL REALITY.”

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I, Markéta Gebrian, confirm that I developed this thesis was by myself. I consistently cited the reference literature.

Já, Markéta Gebrian potvrzuji, že tato práce byla vypracována samostatně, důsledně jsem citovala použitou literaturu.

In Prague, 09.02.2022 Ing. arch. Markéta Gebrian

“Can architecture be digital?

Architecture is the process by which the organisation of activities in space is defined.

Physical or virtual…

Defining virtual reality, places of transit, meeting places, how to access information by means of a special code, using virtual material (nought and ones), with a result that – whenever or not it is similar to the construction of the physical world – is an activity proper to architecture... Up until now, architecture has operated principally with space, because building meant finishing a process. Now, in the digital world, time to belongs to architecture. New architecture organizes what has come to be referred to as ‘heightened reality’, where the physical and the digital relate. Buildings and spaces also begin to more actively include time and its self-transformation. Architecture is then the creator of processes, rather than of infinite events. As a process, it can be digital because it does not require material.” Vincent Guallart

The goal

The of this dissertation is to present new possibilities that are now opening for architects and artists. I will present VR architecture. Architects, artists and VR, IT specialists, engineers would design VR architecture. I want to show that we need collaboration between those professions. We experience growth of need for online meetings. 2D internet exists, it is possible to enjoy so many websites with esthetical designs. 3D internet in virtual reality is still at the beginning of its evolution. Investments in VR technologies are growing example: the Facebook company designs META project for VR and AR meetings of avatars. META company is now not searching for architects to join their team. The company is searching only for programmers and game designers as creators of the new metaverse. In my opinion, architects should be involved in creating VR spaces. Because it is the job of architects to organize activities, it doesn’t matter if it is physical space or digital space.

Another goal of this dissertation is to show the history of virtual reality and VR technology with its application in artistic and architectural fields. There are examples of VR Art and VR architecture.

My Definition of VR Architecture in the Metaverse:

VR Architecture exists only in computer simulations in the metaverse. VR architecture is not for construction in the physical space. Avatars inhabit VR Architecture in social VR platforms (like Neos VR or the new META) or other types of metaverse for education, work, shopping, or gaming. VR Architecture applications are in 3D environments, virtual worlds in social VR platforms in the metaverse and the 3D internet of the future. VR Architecture is a 3D environment inhabited by avatars online designed by architects, artists, and programmers in collaboration. This dissertation is a sample of how art and architecture can inspire VR architecture. How to define VR architecture and how to design it, what are the steps that architects could take if they create it? These are the questions that I am searching for answers to. Application of VR Architecture is in 3D internet or social VR worlds in the metaverse.

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Plus, I present one project from the Fulbright Scholarship in the USA. I focus on VR Architecture for educational purposes, VR classes. VR architecture for social distancing even after and during the COVID-19 crisis when we stay online connected with others through social VR platforms like Neos VR. There is an overview to the recent new technologies of VR like VR suits, there is a list of new metaverse projects, topic of cryptocurrencies, blockchain. There is a chapter about Facebook new company META and how now 3D internet looks like.

Abstract

My research is looking for new interpretations of architecture in our digital era.
I define VR Architecture, architecture for the metaverse, virtual 3D environments online, 3D internet. There is a new direction in architecture developing in the metaverse. I will use literature as well as my case studies to support my ideas. I will find evidence that should show how important the virtual space became in our age. During Covid pandemic era we learnt how important is online education and online work from home. 2D internet is essential now. My dissertation is about 3D internet, the metaverse and how to design it. Programmers, IT specialist, VR specialists together with architects, designers, and artists should participate in the design of these architectural and artistic spaces for virtual reality online environments, the metaverse.

Acknowledgement

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Keywords

VR Architecture. Architecture. Digital Architecture. Metaverse. 3D internet. Virtual worlds. Virtual environments. Virtual space. Virtual reality. Digital art. Cyber art. Generative Arts. Neos VR.

Introduction

Architecture should quickly reflect the change that is happening in our digital era. We cannot imagine living our lives without using smartphones, tablets, computers. We are creating our virtual lives on social media like Facebook and Instagram etc. We use the internet many times a day for communications with others. We work online with colleagues, we study online. We use online banking, book our holidays online, we shop online, we navigate with maps online every day. Some activities from physical world moved online to virtual space on 2D screens of our computers or phones. There is a 3D internet with 3D virtual reality environments, the metaverse. Today most of the metaverse projects are designed by game designers and programmers, VR specialists. The topic of this dissertation is that architects and artist should be part of the team designing the metaverse. I am trying to answer how to design the metaverse as architectural and artistic spaces in virtual reality.

Beatriz Colomina in 2017 during her lecture in Prague asked the question: If we no longer pay attention to the existing cities, what will happen?

My question is: What happens in virtual reality architecture online if people will be inhabiting that virtual space?

We are architects, designers, artists, we should design architectural and artistic 3D space in virtual reality, the metaverse.

Hypothesis

Digital Art is Growing into Architecture for Virtual Reality. Vincent Guallart writes about the meaning of the word digital: *"New Technologies make it possible to transform data flow to the point of creating authentic landscapes. Spaces with or without gravity. The paradigms and the physical laws of the real world are not necessarily applicable to the virtual world. But this virtual world could be a clone of a real-world or generate infinite possible spaces, like a world with infinite times and therefore infinite possible, parallel histories. Quasi-real spaces. An acoustic space: a music room. A fractal trajectory. A mountain*

of infinite dimensions. Cloudy dawn: a city. Settings for virtual meetings and real use. Spaces and computer programs accessible from an intermediate space that can lead to a virtual world full of real content." Architectural and Artistic Spaces through Virtual Reality will become a new direction in architecture in the future.

Research Questions

Actions from the physical world are moving to the virtual world online. We communicate online, we work with online information, we study with online information, we search for information, we socialize online, we share information online, we relax by reading texts and watching videos, we play games, we shop online. We use websites to search for information in 2D screens of smartphone, tablets and computers.

What if in future the online actions will happen in online 3D virtual shared worlds in virtual reality/metaverse, designed by architect, artist, and IT professionals?

What kind of activities will move into virtual reality online worlds?
How can we define functions from these activities in virtual reality online worlds?
What kind of elements will these functions need to create 3D space in VR?
How can we as architects and artist design Architectural and Artistic Spaces in Virtual Reality in social VR platforms, in my case in Neos VR?
Will Architectural Space for Virtual Reality be developed as a new direction in Architecture?
How can we design Architecture for Virtual Reality?
How Architecture for Virtual Reality will look like?

Methodology

I work mainly by using the method research by design, I am searching for supporting materials in literature, I use logic induction and deduction. I am comparing the design guidelines from Vitruvius Ten Books on Architecture and the possibility of designing architectural and virtual worlds in NEOS VR. I try to define new elements and new functions for Architectural and Artistic Spaces for VR. I look for supporting materials in the history of art and architecture that shows evidence from the theory of architecture in history from Vitruvius book De Architectura. I use a recent book about elements of architecture from OMA/AMO, Rem Koolhaas Elements, the result of this research was shown on Venice

Biennale in 2014.For the research purpose, I create 3D models, renders, digital collages, models in virtual reality and animation. I try to verify my principles, the hypothesis, and the research questions. My findings are compared with recent research in the field of contemporary digital art, contemporary digital architecture. By my methods, I would like to find new meanings of the word architecture and define Architectural and Artistic Space Through Virtual Reality, VR Architecture in the metaverse.

Literature Review.

Introduction

Architects are continuously defining and redefining what architecture means, what is architecture and what is not. With the fast growth of the use of digital media that are used by architects, designers and artist, I need to redefine also what it means contemporary architecture today. In the past, there were many projects designed not for construction, they but for testing ideas and push the boundaries of architecture further.

Definition of architecture by Manuel Gausa:
"To know the nature of things to act upon reality. Thus, begins architecture"..."If one of the greatest responsibilities traditionally placed upon the figure of the architect is the capacity for synthetic action between the conditions of reality and a vision of the world, it is in this sense that prospective "recognition" of new definitions of our environment acquires special importance, not as a shaping, reaction or reproduction of reality itself, but rather as prospective reformulating 'disposition' vis-à-vis that reality."...„To recognized reality is to begin to transform it. "

But what if our reality is virtual reality? What kind of processes do we need to observe? What type of actions are not useful in virtual reality environments? What can be our reaction and interpretation of reality transformed into virtual reality?

This introductory part will show the aim of the dissertation and an overview of the current state of the scientific issue (with references to the literature).

Virtual Reality and Computers.

Devices for VR represents an interface, a way of interaction, the dialogue of human being and computer. VR is also a way how to present complicated information, manipulations, and interactions with the human and computer. VR is the most immersive possible interaction with the computer so far.
Short History Computers and VR technology and Basic Terminology:
The computer as a term exists from 1613. It was describing a person who did calculations or computations. Until the end of the 19th century was the computer used the same way. Computers had the primary use to calculate during the industrial revolution and the rise of machines. Alan Turing designed the first modern computer in 1936. He built the foundations for the theories about computers and computing.

"In 1936, Turing published a paper that is now the foundation of computer science. Turing analysed what it meant for a human to follow a definite method or procedure to perform a task. For this purpose, he invented the idea of a 'Universal Machine' that could decode and perform any set of instructions. In ten years, he would turn this revolutionary idea into a practical plan for an electronic computer, capable of running any program."
"In March 1946 Turing produced a detailed design for what was called the Automatic Computing Engine (ACE.) It was a digital computer in the modern sense, storing programs in its memory. His report emphasised the unlimited range of applications opened by this technological revolution, and software developments ahead of parallel American developments. Yet his relationship with NPL soured and he left in 1948 before a pilot version of the ACE was made in 1950." Andrew Hodges

There exists a simple rule for using machines. It works like this: The more complicated the computer, the more complex interface the computer has communication with the human. Machines interacted with people only by buttons and holes in the paper. There was a possibility to communicate through texts. The communication between human and computer worked like this. A person could write on the keyboard the program according to that the computer knew what to do. As a result, there was an answer from the computer by the text. It was much easier to communicate with the computer by developing the graphic interface GUI in the 70. It means you could work with the computer by the mouse and clicking to the icon, image. As a result of that, the computer could give you the answer an image, text, or a sound.
Each time we need to put the information to the computer, we get the response back from the computer. Today the virtual reality devices are so advanced that we have a chance to be immersed with the 3D environment and navigate through this space being surrounded by information and manipulate with them. We can experience being in a 3D world in VR that has never existed before. We as humans can easily naturally observe and understand spatial information because it is how we live in daily life. Now we can use this with the work with the computer. The Sci-fi story Neuromancer used the world cyberspace 1982 by William Gibson.

What is cyberspace: cyber- according to etymology online is*: „word-forming element, ultimately from cybernetics (q.v.). It enjoyed explosive use with the rise of the internet early 1990 s. One researcher (Nagel) counted 104 words formed from it by 1994. Cyberpunk (by 1986) and cyberspace (1982) were among the earliest. The OED 2nd edition (1989) has only cybernetics and its related forms, and*

cybernation "theory, practice, or condition of control by machines (1962)." etymonline.com

What is the **virtual environment**? It is the world that exists only in the memory of the computer. *Environment (n.) c. 1600, "state of being environed" (see environ (v.) + -ment); the sense of "the aggregate of the conditions in which a person or thing lives" first recorded 1827 (used by Carlyle to render German Umgebung); specialized ecology sense first recorded 1956."* etymonline.com **Virtual reality: virtual (adj.)** late 14c., *"influencing by physical virtues or capabilities, effective concerning inherent natural qualities," from Medieval Latin virtualis, from Latin virtus "excellence, potency, efficacy," literally "manliness, manhood" (see virtue). The meaning "being something in essence or effect, though not actually or in fact" is from mid-15c., probably via sense of "capable of producing a certain effect" (early 15c.). Computer sense of "**not physically existing but made to appear by software" is attested from 1959**."* etymonline.com

Virtual reality means that we can immerse with the interactive 3-dimensional environment. The father of **virtual reality** Jaron Lanier used the first term virtual reality in 1989. Virtual reality means that we can immerse with interactive 3-dimensional environment. The father of virtual reality **Jaron Lanier** used the first the term virtual reality in 1989.

Chris Milk TED speech is about VR:

„So here's what's special about VR, in all other mediums, your consciousness interprets the medium, in VR your consciousness is the medium."

My first experience with VR was very emotional. I fell in love completely with the device. I put on the VR headset so I could look at my 3D VR model magic flower. Oher programmers helped to transform my 3D model into VR. The second one was when I was drawing 3D structures with colourful brushes at CTU Prague. I saw the potential immediately. I knew from this moment that architects should have some education and knowledge of virtual reality technology because even in the basic architectural practice testing, of the 3D space built or not is needed. Virtual reality is the most immersive 3D environment the recent technology can offer.

Of course, there are other devices like AR glasses, for example, HoloLens. Greg Lynn and his students at UCLA use HoloLens to test the spaces that they design in 3D. That is an improvement for architectural students. In my opinion, it is more accurate to use virtual reality technology. In VR, I can precisely design the 3D space in the sizes and conditions needed. I can walk or fly in the 3D environment as precise as I created it.

I became a part of the community on Facebook that is interested in metaverse called The MetaVerse Research. There are posts about metaverses that are new to me. It is exciting to observe how people think of the metaverse. How they design it, how they are using the metaverse. In most cases, architects are not involved in the discussions and designers of the metaverse are called 3D assets builders. In TCG World metaverse some videos show a landscape with mountains, rocks, trees, grass, villas, avatars are walking in the ground. It still creates copies of some physical environments. I know that opinions are saying that transition between the real and virtual environment should be slow and smooth. People don't want to be shocked by the unknown space in VR. Well, in my opinion, there can be both approaches. Mine is the unknown direction of designing spaces.

Technology and history of virtual reality. Ideas about VR in Sci-Fi literature. Cyber art in VR, Social VR platforms in the 21st century.

Teatro Farnese 1618

The Baroque Stage from 1618, it is the first attempt of virtual reality. It was attempting to travel to other worlds. Theatre produced with the help of illusions made of paintings, illusory tricks and mechanical devices an impression of infinite space and created depiction of perspective as well.

1787 The Panorama

See more about this project in the following chapters.

1838 The Stereoscope

Charles Wheatstone invented a device to simulate the depth of the field in the two-dimensional image. When a person looks at two pictures from the same scene, but from a different perspective, our brain reads it like a three-dimensional image.

1898 The invention of Lenticular Printing

An array of tiny magnifying lenses or prisms produces an image with a 3-D effect.

1935 Pygmalion's Spectacles

There was a fictional scenario of virtual reality described for the first time in Stanley G. Weinbaum novel's Pygmalion's Spectacle. A scientist develops eyeglasses. These glasses immerse the viewer.

1939 The View Master

Edwin Mayer invented and William Gruber the View Master. Up to 7 stereo image pairs can be viewed inside.

1950 The Veldt

The Ray Bradbury tells the story of the family living in an automated house. The children have their virtual reality room that can reproduce any place they imagine. Bradbury develops the scenario of a spatially immersive illusion that can be realized without technologies.

1957 Sensorama

So-called cinema of the future. Morton Heilig presents not only stereoscopic 3-D image, but also for example with wind and fragrances, that makes the viewer feel like he is part of the scene in his Sensorama. But Sensorama remains only as a prototype.

1960 Telesphere Mask

The inventor Morton Heilig introduced stereoscopic TV viewing experience.

1961 Headsight

The first head-mounted display developed by Philco Corporation for military purposes, projected screen for each eye without computer simulation. The 1960s were important years for virtual reality innovation because the head-mounted display was capable of motion tracking. It was the first step for the evolution of VR HMD.

1963 Teleyeglasses

Hugo Gernsback invented a Teleyeglasses, but they never became produced and remain as a concept stage. He was a Luxembourgish-American inventor, writer, editor, and magazine publisher, best known for publications including the first science fiction magazine.

1964 Simulacron -3

Was a book (also published as Counterfeit World), by Daniel F. Galouye, is an American science fiction novel featuring an early literary description of a simulated reality. Daniel Galouye describes a virtual metropolis that is used for market research. The city's inhabitants possess independent, individual consciousness, but they are unaware, except for one, that they are only electronic impulses in a computer, their world exists only in virtual space. The person who computer-simulates the city progressively grasps that his world is probably not "real" and might be only a computer-generated simulation.

1965 The Ultimate Display

Ivan Sutherland developed the concept of the ultimate utopian display. The Ultimate Display spreads over an entire space. The computer assumes control over the material, the entire virtual environment is comprehensible and impacts all 5 senses.

"The ultimate display would, of course, be a room within which the computer can control the existence of matter. A chair displayed in such a room would be good enough to sit in. Handcuffs displayed in such a room would be confining, and a bullet displayed in such a room would be fatal. With appropriate programming, such a display could be the Wonderland into which Alice walked." (Ivan Sutherland 1965)

1967 TV Helmet (Portable Living Room)

Walter Pichler, an artist from South Tyrol introduces his TV helmet. An HDM with built-in television. This invention had a very strange shape.

1968 The Sword of Damocles

Ivan Sutherland was behind the first head-mounted device, and it gained the name The Sword of Damocles, because of the way it hung over the viewer. As Sutherland writes in his early paper about the device, it worked right away. "Even with this relatively crude system," he wrote, "the three-dimensional illusion was real." Its appearance is highly comparable to even the most advanced devices of today.

1973 World on Wire

Rainer Werner Fasbinder two-part mini-TV-series Word on Wire is the first film based on novel Simulacron 3. Everything turns out to be a simulation.

1975 Videoplace

Myron Krueger presents the first comprehensive responsive environment, so-called VIDEOPLACE. In various places, two people are captured by a film camera and can interact on a projection surface in a virtual place. Both individuals can move about at will without data glasses and data gloves. Krueger calls the VIDEOPLACE also ''artificial reality''.

1976 Data Gloves

Thomas de Fanti and Dan Sandin presented their revolutionary approach when they designed Data Gloves. It is a device for human-computer interaction worn like a glove. Sensors capture physical data like bending of fingers. Gestures can then be categorized into useful information, such as to recognize sign language or other symbolic functions. Data gloves can also provide haptic feedback, which is a simulation of the sense of touch .

1980 EyeTap

Steve Mann presents his EyeTap HMD, it expands the reality and complements the sensory perceptions with computer-generated information.

1982 Tron

Sci-fi movie about programmer Kevin Flynn who tries to get into the computer "Master Control Program" and gather some evidence information he needs. During his incursion, the "Master Control Program" transforms Flynn into data and traps him inside the computer. With the aid of security program Tron, Flynn tries to break out of the virtual world and destroy the "Master Control Program".

1982 The Judas Mandala

Sci-fi novel author Daniel Broderick that uses for the first time the term "virtual realities'' and "virtual matrix'' writes about time-travellers in the future populated by human-machine hybrids.

1984 Neuromancer

Is a novel of William Gibson where main protagonist, Henri Dorsett Case lives in near future when brain-computer interfaces move people through „MATRIX" a global virtual network. For Case, the virtual reality is a 3-dimensional network of data nodes.

"People have been on the internet for years, and what takes place seems more fantasy than reality at times, especially the virtual reality, which is something people have strived for, but still is unsatisfactory in practical application. I say yes; not due to the description of future technology, which science fiction authors will never get completely correct (though Gibson is a better futurist than most writers), but because of the engaging plot and the intriguing characters. The host of characters includes regular humans, modified humans, clones, computer constructs of people, and AI (artificial technology) ". Christopher Fried

1985 VPL Research

Jaron Lanier and Thomas Zimmermann founded VLP Research, the first company that does work in the field of modern virtual reality. The designed the first products like "Data Gloves" or "EyePhone"an MHD

that makes possible for the user to immerse in virtual space and also full body "DataSuit" that track the movements of arms, legs and a torso.

1987 Jaron Lanier establishes the Term Virtual Reality

The term Virtual Reality was for the first time used in Judas Mandala by Damien Broderick, but Jaron Lanier and his VPL Research is considered as a creator of this term and the one who establish it and popularizes it as well.

1987 The term virtual reality is written in the Oxford English Dictionary

"The computer-generated simulation of a three-dimensional image or environment that can be interacted with in seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors." (Stuart J. Barnes 2016).

1988 Legible City

Cities like Manhattan (1989), Amsterdam (1990), Karlsruhe version (1991) made up of letters and words that can be viewed by a visitor by cycling on a fixed bike. Computer graphic installation by Jeffery Shaw, with Dirk Groeneveld. This project is especially interesting for me because it shows a vision of an interpretation of different existing cities in computer graphic installation.

1990 View, Virtual Interface Environment Workstation

NASA begins to collaborate with Jason's Lanier VPL firm on a virtual visual environment display VIEW. This technology works with virtual multisensory. The aim is to test environment that uses telerobotic to explore unknown or dangerous terrain.

1990 Augmented Reality

Thomas P. Caudell develops the term Augmented reality. Thoma P. Caudell, the researcher at Boeing, came up with an idea of an HMD that can display all the various schematic diagrams of many different aircraft right before the eyes of workers on the assembly plant floor. People can revise plans on the PC, which eliminates the adaptations and revisions of elaborates of analogue documents. Caudell calls this concept of Augmented Reality.

1991 Virtuality

Virtuality Groups distributes „Virtuality Pod", it was a VR system that promised to immerse users with thrilling virtual worlds. The creators of The Virtuality Pod had to cancel it. The quality of games and Virtual Pod could not deliver the promise of futuristic design.

1992 Cave

Cave Automatic Virtual Environment – CAVE, 3 to 3 meters large, developed by Carolina Cruz-Neira, Dan Sandin and Thomas de Fanti at the Electronic Visualization Laboratory in Chicago. In CAVE 3D effect is produced by stereo glasses, it makes it possible for several users to explore virtual worlds together.

1992 Snow Crash

In his novel, Neal Stephenson presents the Metaverse, how he envisions the further development of the Internet into virtual space. Avatars/users populate the Metaverse. Humans flee from a reality in which large corporations have sized power and governments exist only symbolically.

1993 America's Finest

Flynn Hershmann Lesson manipulates real space with digital fiction and thus prompts installation visitors to reflect on their relationship to warfare, weapons, media.

1992 Home of Brain

The interactive art using virtual reality is an installation by Monika Fleishmann and Wolfgang Strauss. They present an imaginary museum, which visitors can explore and discover with an "EyePhone" system, a product of VPL research.

1993 Inter Dis- Communication Machine

Kazuhiko Hachiya's created a system aimed at transmitting and receiving sensual experiences. Used by two people wearing head-mounted displays, the 'machine' projects one wearer's sight and sound perception of the environment into the other one's monitor, borders between f 'you' and 'me' are blurred.

1993 Simulation Room – Mosaic of Mobile Data, Sounds, Knowbotic Research

In the installation, visitors can move in a dark space. They are guided by a little monitor just in front of them, showing their position and how close they are to certain groups of data. There is also a projection screen for the public who can follow the sound events in visual form.

1995 Virtual Boy

Company Nintendo developed a VR headset for games. It was a device that displays stereoscopic 3D images, after 1 year and only 20 games the product was cancelled.

1995 Las Meninas

"In Michael Tolson's installation "Las Meninas", two observation stations are supposed to tempt the participants into voyeuristic behaviour. From a low podium, the artificial creatures can be fed with a sensor. The result can be viewed through a pair of binoculars which are facing the reflection of the monitor. "(Ars Electronica Festival 2018).

1995 Be Now Here

See more about this project in the following chapters.

1995 Strange Days

See more about this project in the following chapters.

1995 Forte VFX1

Another unsuccessful project to put on market new VR headset.

1995 Global Interior Project

Masaki Fujihara creates an installation about interactive stations that provide access to virtual space and visitors can communicate with each other in those stations. The system is linked to the installation in real space.

1996 Bodies Incorporated

See more about this project in the following chapters.

1997 Able Skin
See more about this project in the following chapters.

1998 World Skin
World Skin by Maurice Benayoun is an interactive CAVE installation. Visitors are armed with cameras, they are making our way through three-dimensional space. The landscape before their eyes is scarred by war-demolished buildings, armed men, tanks, etc. Visitors are taking pictures; and here, photography is a weapon of erasure.

1999 ARToolkit
Hirokazu Kato presents ARToolkit, a kind of software library that enables anyone to develop an AR application. Kato solves the main problem of AR- user's precise location is tracked so the app can overlay reality with the computer-generated model.

1999 Matrix
See more about this project in the following chapters.

1999 Minesweeper
One of the first multiuser game online.

1999 eXistenZ
See more about this project in the following chapters.

2000 ARQuake
Augmented reality is used for games for the first time. Players are in the real world with an overlay of virtual reality of Quake.

2002 Minority Report
A Famous sci-fi fantasy film using a concept of augmented reality. Humans interact with interfaces via gestures. A simple motion of the hand can make digital data appear.

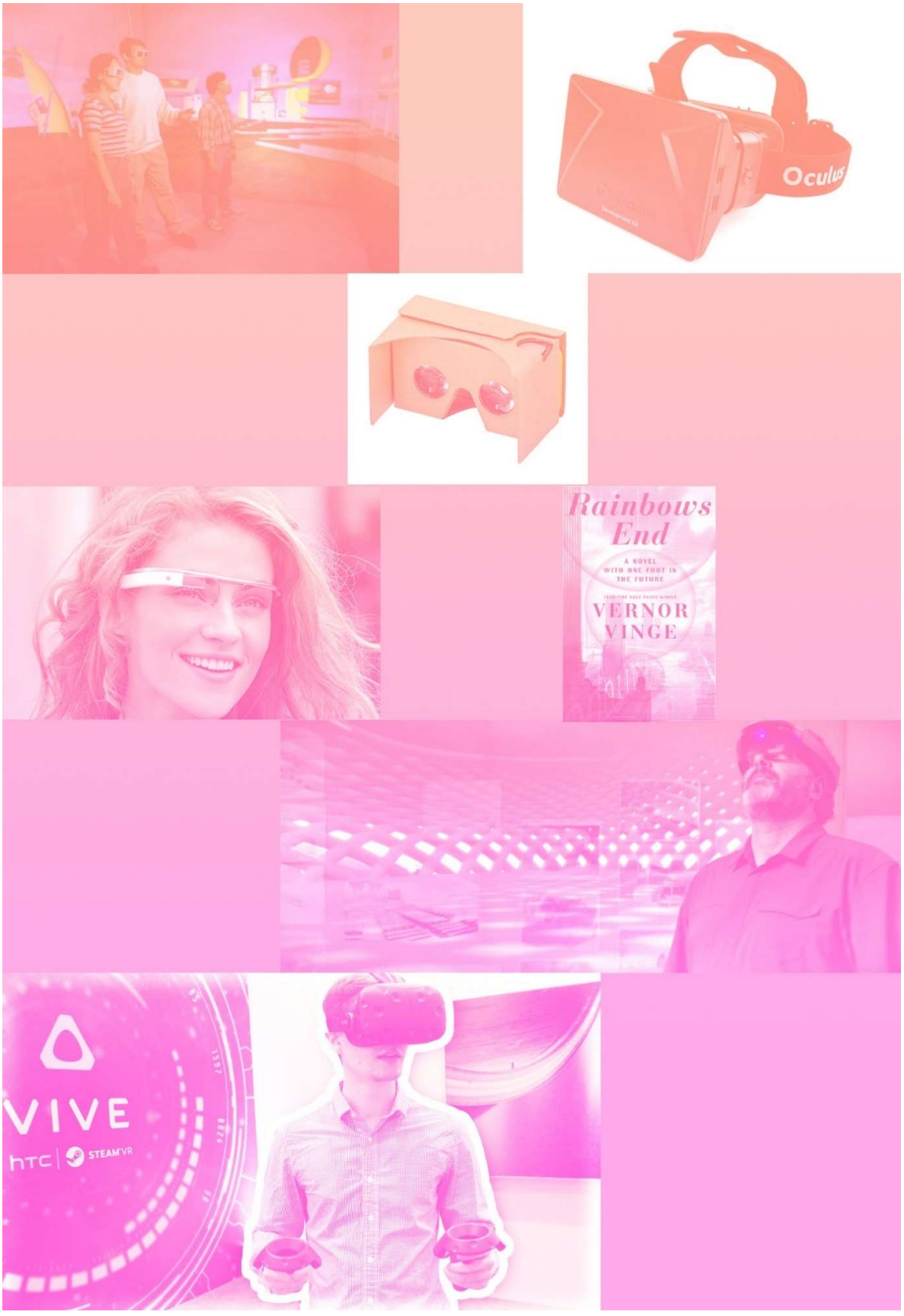
2002 Hidden World of Noise and Voices
"Ars Electronica Futurelab guest artist Golan Levin came up with a new approach to the visualization of sounds in a multi-user augmented reality system." (Ars Electronica Festival 2018)

2002 Instar
The automobile industry used augmented reality technology.

2003 Gulliver's Box
The Ars Electronica Futurelab and Prof. Hirokazu Kato from Osaka University, they used mixed reality applications in art and science. It is an innovative project between theatre, film and installation. With it, performances by dancers, singers or actors can be recorded, transferred to avatars, and enhanced with any computer animation.

2003 Second Life
See more about this project in the following chapters.

IMAGES FROM THE TOP LEFT: MARKÉTA GERBIAN - EMOTIONAL SPACE. THE BOTTOM LEFT P: IHEARTBLOB - MIAMI VICE.



IMAGES FROM TOP LEFT: CAVE, OCUCUS RIFT VR HEADSET, GOOGLE CARDBOARD, GOOGLE GLASS, BOOK RAINBOWS END, HOLOLENS USED BY GREG LYNN, HTC VIVE HEADSET.

2003 Can You See Me Now

See more about this project in the following chapters.

2004 Apparition

It is a dance and theatre performance with sensors and tracking technology developed by Klaus Obermaier and Ars Electronica Futurelab.

2004 Das Rheingold

This performance with stereoscopic projections opened up the walls of the concert hall onto a virtual panorama. The computer-controlled scenery followed Wagner's work and reflected the interpretation of the musicians in the form of a dynamic structure.

2005 Digital Graffiti

"Virtual messages are superimposed on the real world (augmented reality (AR)). The user can take a picture of the surroundings with a mobile phone camera. The digital graffito is a collage on the camera photo. One possible use for this function would be for applications in tourism. Digital messages could be attached to pictures of a local sight to provide information about the building."

2005 Gulliver's World

Ars Electronica Future Lab with Hirokazu Kato developed a mixed reality installation that projects visitors as 3D figures in real-time. Visitors can arrange this world and its components.

2006 Mahler's Resurrection Symphony Visioned

Futurelab of Ars Electronica and the artist Johannes Deutch from Vienna created the illusion of the three-dimensional space.

2006 Le Sacre du Printemps

It is a project that applies technology and creativity to Stravinsky's Le Sacre du Printemps. It is a collaboration of the Ars Electronica Futurelab's and Klaus Obermaier. Musical impulses and dance create a 3-D space.

2006 Rainbows Ends

It is a novel about the world where AR and VR technologies are part of everyday life. VR and AR are enhanced type of contact lenses. Laptops and headsets are archaic.

2008 Smartphones and Augmented Reality

AR Travel Guide was an AR app released by a company named Wikitude.

2009 Deep Space

Deep Space replaces the CAVE.

2011 Black Mirror

See more about this project in the following chapters.

2012-2013 Oculus Rift and Google Glass

Palmer Luckey develops Oculus Rift, an HDM for home use. And google presents data glasses Google Glass, which overlay data and reality. Google Glasses are can be used to search for information online.

2014 Google Cardboard
A cardboard device for smartphones, low-cost VR device.

2015 Quasar
The futuristic design of a three VR sculptural helmets, that houses a VR headset, which is connected to a PC. The project explores visions of a near future and what it will mean to be human.

2015 HoloLens
HoloLes is a wearable computer, that let you see holograms mixed with reality. This device was promoted with the collaborations of the architect Greg Lynn.

2015 In the Eyes of the Animals
Beautiful VR project that creates an environment that is interactive and created by the sensory perception by animals.

2016 Pokemon GO
AR game, the world of Pokemons was overlaid on the real world. Hunting Pokemons with AR application was a huge hit.

2016 VR, AR is going mainstream
VR technology goes to stores, the most famous brand is “Oculus Rift” and “HTC Vive”, but also other high-quality VR headsets are available for home use from different companies.

2016 Futuristic Visions for Augmented Reality and Virtual Reality
Computers will become part of our body as some sort of enhancements of our real body parts.

2018 Ready Player One
See more about this project in the following chapters.

2019-2021 Growing number of metaverse projects.

2021 I call it “META Age”
Facebook is developing a new metaverse with AR and VR, META. Other new metaverse projects emerged and they are fully functional in the metaverse:
Metaverse CEEK, Decentraland, Illuvium Metaverse, Bloktopia Metaverse, Enjin, Audio Metaverse, Axie Infinity Metaverse, blockchain games.

2021 NFT’s boom
In 2021 there was a huge boom of selling NFT’s with crypto currencies.

Conclusions:

How is this search in virtual reality projects related to architectural space? In some cases, I found projects that are linked, because they are interpreting architectural space. For example, in 1787 the painter Robert Barker created The Panorama from the painted city, or when in 1964 in Simulacron -3 Daniel F. Galouye wrote about his virtual metropolis in a book. This computer-simulated city was filmed in 1973 as World on Wire. The similar interpretation of the virtual world is in TRON 1982 sci-fi movie. These film visions are very valuable for the design development of the virtual worlds now when we have the available technology to create VR environments. We can inspire from those movies as architects, designers of VR worlds.

"Generate Consensus. Hard science gives us definitive parameters as to what is or is not possible, yet these settled sciences may be re-read and re-understood. Part of the position in which architecture takes is that of a hard science yet it's another half a knowledge Philosophy as a mediator between hard science and esoteric nonsense". Iheartblob (2018)

These images from above can be understood as from the same era and the same VR environment, but they are not related at all. In 1988 the Legible City presents VR cities like Manhattan, Amsterdam, Karlsruhe made up from letters. In 1995, in project Be Now Here, visitors with 3D glasses can visit cultural heritage sites for example Jerusalem, Dubrovnik, Timbuktu, and Angkor, Cambodia. That is a very similar concept to HoloLens VR Tours in 2016. 1997 Able Skin project interprets villa Rotonda into VR. In 1999 the film Matrix predicts virtual environment that is unrecognizable from the real city. In 2003 Second Life is a social VR platform the is offering different VR environments to explore by your avatar, you can visit architecture or landscapes in VR. Today the most known social VR platforms and metaverse are:
Facebook META
https://about.facebook.com/meta
Sansar, https://www.sansar.com/
AltSpace VR, https://altvr.com/RecRoom
https://store.steampowered.com/app/471710/Rec_Room/HighFidelity
https://highfidelity.com/.
And new ones: Metaverse CEEK, Decentraland, Illuvium Metaverse, Bloktopia Metaverse, Enjin, Audio Metaverse, Axie Infinity Metaverse, blockchain games.

Neos VR is a new Czech social VR platform emerging today. In the past, we could see some attempts to design architectural space in virtual reality with different tools and technologies. But what is completely new in architectural spaces for virtual reality? The freedom while designing by using the whatever shapes, colours, we also don't need to deal with gravity, so structures can float and consist of even not connected parts. The possibilities are endless.
For this reason, I was searching back in reality how to connect the virtual worlds and real sites, cities. I realized that we humans are always comparing experiences from our lives to something we are experiencing for the first time. It is not bad to relate to virtual and real sites. Because if you are designing virtual space it helps to deal with the real context, inspirations and built architecture and urban plan.

IMAGES FRPOM THE TOP LEFT: FILM READY PLAYER ONE, FILM THRONE, IHEARTBLOB - ACT IV. WHAT APP WOULD BORROMINI DOWNLOAD? GENERATE CONSENSUS. IHEARTBLOB IMAGES FROM THEIR INSTAGRAM.

Introduction to the NEOS VR metaverse. Possibility how architects can use this platform for importing 3D models into virtual reality.

Neos VR is a social VR platform, metaverse that is available on Steam VR for free. Data are saved on the cloud of Neos. To use Neos it is essential to create an account in Neos with login information and password. You have 1GB space available for free to import 3D models into Neos VR. Right now, Neos VR is mostly used as a platform where you can meet other avatars online, create own worlds and import 3D models and then you can move in the metaverse and share and show the space to other avatars in VR. When you are logged in, there is the main menu where you can find several buttons that you use for work in Neos.
Of course, it is possible to enter and test other VR worlds that have been created by other VR specialist, these are saved in Content Hub. A content hub is a gaming type of building where there are Social, Games, Art, Educational VR worlds, Tutorials, and 3D scans. On the round-shaped display, you can find a selection of these VR worlds and by clicking on them you enter the selected VR world. For architects, I see two different use of Neos VR. The first application is that architects can show their 3D model imported from another 3D program. Model in Neos VR is available online from one or multiple accounts, stations that are also connected online. To create your own world, it works like that you click on button New World and import the 3D model in FBX format. It is possible that the model will have different scale and size, it will lose the textures. In Neso it is easy to adjust those properties and import JPG formats, images and usually it is necessary to texture the 3D model again. It is possible to create an interactive environment almost like a game set, but that requires advanced visual programming called LOGIX. Worlds are saved into Inventory on Neos cloud space. Second use will happen I hope in the future, it is that we will use the virtual world to manage our activities and duties that we do now in the physical cities. Those activities will in future not even happen on the screen of the computer on some websites but in VR 3D worlds, in social VR platforms like Neos VR. There is a great potential and opportunity to use virtual worlds online because the 2D flat screen will be in future hopefully replaced by 3D interactive virtual worlds. What will be happening in these 3D worlds? Who will inhabit them? I assume, that people will have their account in the social VR platforms, so they can access in the body of an avatar the online virtual worlds. I hope that these worlds will be derived from physical worlds, physical cities, built architecture, but these new online 3D virtual worlds won't be copies of existing environments. Recently we can find many projects in VR that are copying existing building, city or some other condition into VR 3D world. There exists a project that is the reconstruction of some space that no longer exist, for example, some historical sites for the purposes of some museums.

What will happen in the virtual 3D worlds it depends on what kind of activities will transform from the physical world into the virtual world online in VR. For example, it will be communication, education, shopping, business, relaxation, games. The only gaming industry is now really developed field in VR. It is part of my research and my case studies to define what kind of activities, functions will occur in

virtual worlds and how we can adjust to the new type of movements like flying and teleporting in 3D space. How can I define these new activities, new functions, and different architecture in virtual reality? I am searching for answers on how the new type of movements in VR like flying and teleporting in VR will transform architecture in VR. Recently existing social VR platforms are very close to the gaming industry. IT specialist, programmers and gaming artist are designing VR worlds, VR environment. But this is where I see new opportunities to connect the architectural field and gaming VR industry with IT together.

There are videos that present Neos VR or various websites: https://www.indiedb.com/games/neos-vr/videos/neos-vr-beta-launch-trailer-2

https://steamcommunity.com/app/740250/videos/
There are some samples of the tutorials for visual programming in Neos VR:

https://www.youtube.com/watch?v=UfSCec37KJ0&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw

https://www.youtube.com/watch?v=dWbm9AzgDxw&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw&index=2

https://www.youtube.com/watch?v=ZqI_j6pDdjg&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw&index=3

https://www.youtube.com/watch?v=toszxzp0pXw&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw&index=4

https://www.youtube.com/watch?v=hEbWIgkZt34&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw&index=5

https://www.youtube.com/watch?v=U68hjR43noI&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw&index=6

https://www.youtube.com/watch?v=rQMeL6hXBU4&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw&index=7

https://www.youtube.com/watch?v=lrac31yw1Qg&list=PLoAvz0_U4_3zkwJQWd8eD8TWyQ0_0JWnw&index=8

Avatars
– representation of humans in VR.
Artificial Intelligence in VR.
AI Avatars in VR.
Avatar's need in VR in comparison to human needs in physical space.

There are three categories of avatars in Neos VR. Automatic avatars that everyone receives when the person is in Neos online. It is just a headset without body and hands. The second, simple avatars with sphere head and hands and the last group are 3D figures that have human-like bodies with legs, body, arms, and head. The third is the most complicated group of avatars because we can import a 3D body that we create in another 3D program. Before we do that, we must import the 3D model to MIXAMO program. It is a program where we can assign joints on the body in the MIXAMO program to the actual points on the 3D model. We must select on the 3D figure where is a chin, elbow, forearms, knees, heels. The MIXAMO program is automatically transforming the 3D body, then we save it and import it in FBX format to Neos VR. There is also a possibility to import from MIXAMO figures that are not representing anybody's avatar. This body can be programmed from MIXAMO to perform some movements like a dance. We can program bodies of avatars like AI in LOGIX. The LOGIX programming is very complex and suitable for IT and advanced users, we can program complex movements of avatar body like flying. We can program the whole environment in VR. In Neos VR, we open the Avatar creator that has another 3D model of head and hands. We have to our 3D figure adjust to the 3D head sphere and 3D hands. Then we click to lightening button then we are reborn in our new avatar body. For some reason, the avatars that have a human body and animal head are popular among the users of Neos VR. Having a body in virtual reality means a lot for the perception of the VR space. Now we are used to the keyboard and mouse or touching the screen. In the body of the avatar, we can inhabit the whole virtual space. Avatars create new activities in virtual space online.
Our body in physical space defines what we can do in that space and what kind of activities we do. There is a similar situation in the virtual reality space.
Activities define the functions and use of architecture in physical space. In my opinion, it is like the situation with the virtual space. We can derive activities that avatars can do in virtual reality.

Saul McLeod writes about human needs in physical space in 2020:
*"**Maslow (1943, 1954)** stated that people are motivated to achieve certain needs and that some needs take precedence over others. Our most basic need is for physical survival, and this will be the first thing that motivates our behaviour. Once that level is fulfilled the next level up is what motivates us.*

1. Physiological needs - these are biological requirements for human survival, e.g., air, food, drink, shelter, clothing, warmth, sex, sleep. If these needs are not satisfied the human body cannot function

optimally. Maslow considered physiological needs the most important as all the other needs become secondary until these needs are met.

2. Safety needs - protection from elements, security, order, law, stability, freedom from fear.

3. Love and belongingness needs - after physiological and safety needs have been fulfilled, the third level of human needs is social and involves feelings of belongingness. The need for interpersonal relationships motivates behaviour, examples include friendship, intimacy, trust, and acceptance, receiving and giving affection and love. Affiliating, being part of a group (family, friends, work).

4. Esteem needs - which Maslow classified into two categories: (i) esteem for oneself (dignity, achievement, mastery, independence) and (ii) the desire for reputation or respect from others (e.g., status, prestige). Maslow indicated that the need for respect or reputation is most important for children and adolescents and precedes real self-esteem or dignity.

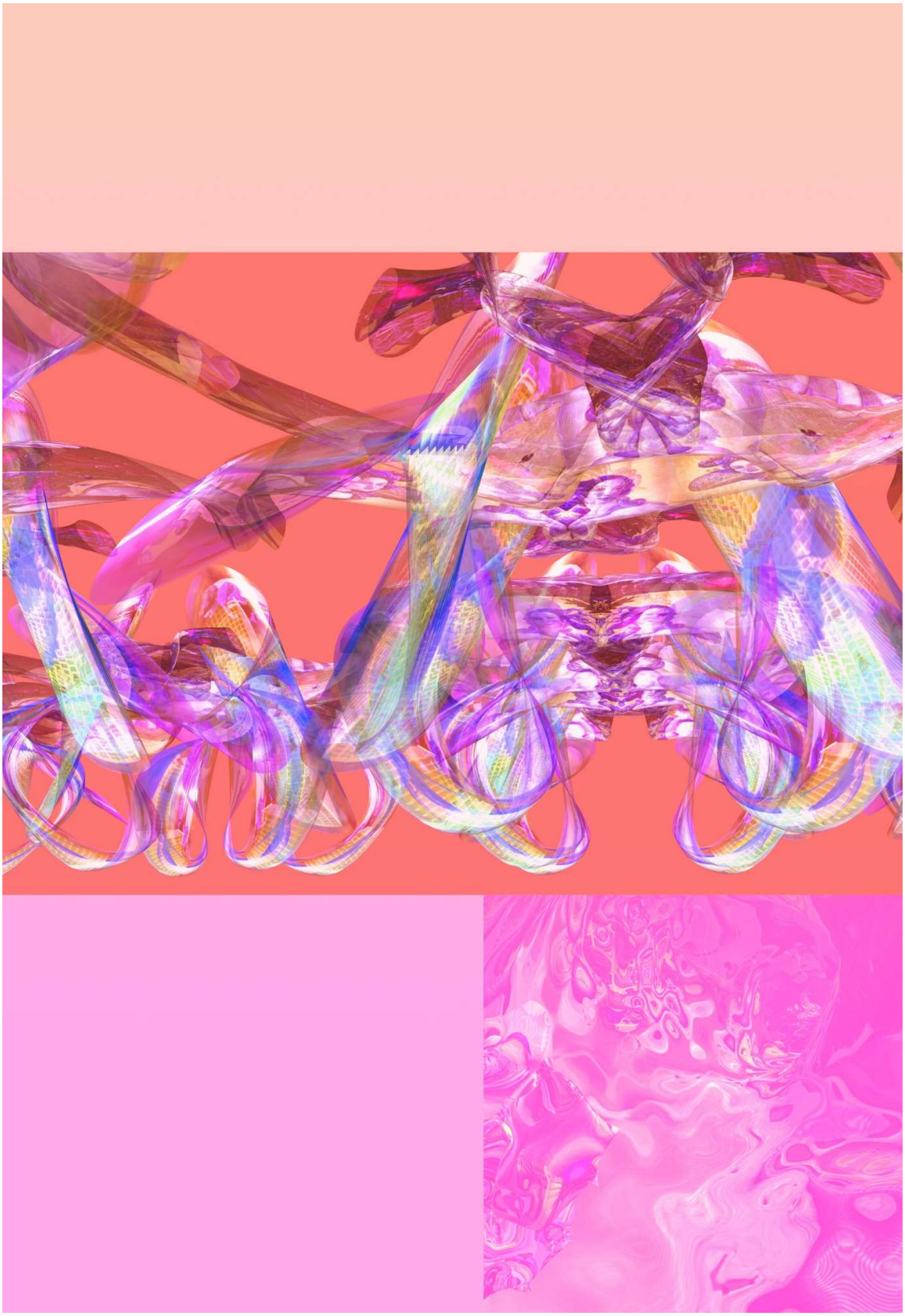
5. Self-actualization needs - realizing personal potential, self-fulfilment, seeking personal growth and peak experiences. A desire "to become everything one is capable of becoming" (Maslow, 1987).
Of course, that Maslow created this list according to the human living in the physical space. I will derive my new list of the avatar's human needs in virtual reality. I assume that I do not want to copy reality or real conditions of built architecture and create a new type of architecture, the Architecture for virtual reality environments. Let's first focus on point one.

Physiological needs are the most related to architecture in the real world. The human shelter is in the history of architecture fundamental function of architecture.
But human survival in VR is not relevant, because we must manage to survive in physical space first. We must breathe the air to be safe and warm in the interior when we are in VR. VR doesn't need to create shelter against the weather conditions, we must be in avatars body in VR, be warm, because VR is an indoor activity usually, sleep in physical space and have sex in physical space.

What kind of activities for a new type of architecture in VR do we derive from this point? Architectural functions are mainly housing, education, work, leisure activities. Back to the body related activities: Shelter in VR is not needed, but I think avatars need spaces that raise different feelings in avatars like the feeling of being happy, calm, safe, isolated, being with other avatars, etc. With the emotion of the space comes together how we can navigate through space by flying or teleporting in VR.

This theme I was dealing within the first two Case Studies I. Magic Flower and Case Study II. Flower in the City. In VR there is no need for bedrooms and sleeping. If I imagine the typical house or flat, there will be no bathroom, bedroom, kitchen, dining room in VR.

There would be a more significant living room, workspace, relaxation, or game room.
I was dealing with this topic in my Case Study III. Interpretation of the house Casa Mila in Barcelona. Spaces for eating and drinking like kitchens, dining rooms, restaurants, bars, cafes are not possible in VR. Instead, I assume that in VR spaces for meeting and communication are needed.



IMAGES FROM THE TOP LEFT IMAGE: MARKÉTA GERBIAN - MANIC GARDEN. THE BOTTOM LEFT: KEVIN MACK, VR PROJECT ANANDALA.

IMAGES FROM THE TOP LEFT: REM KOOLHAAS PLAN OF DREAMLAND, RAIMUND ABRAHAM - ARCHITECTURE, BUCKMINSTER FULLER – DOME OVER MANHATTAN, PAOLO SOLERI – MESA CITY, YONA FRIEDMAN -PARIS SPATIAL.

Activities in VR space are kind of morphing into new type of actions and activities, that will define new type of functions for architecture in VR.

Not only housing but also work, education and leisure activities can profit of VR online worlds like NEOS VR. The education system and all types of schools and universities would benefit from the VR. There is a possibility of how to use VR for education purposes. There is a project, World of Comenius, more information:

https://www.youtube.com/watch?v=wsUfaNRBARQ&t=13s

In this project, we see how to use a skeleton 3D model in biology. This project in VR shows a better image of the whole human body in VR. My question is what kind of spaces I can imagine building in 3D to design a new type of classroom or education space. This problem I will try to solve in my next case study V. Interpretation of the hunt Library in North Carolina Stace University campus in the USA. I was awarded the Fulbright Scholarship at NC State for six months in 2021 .

Safety needs in VR - protection from elements, security, order, law, stability, freedom from fear. In VR we can protect our VR worlds from other avatars by creating special access to the 3D online world in Neos VR selecting people who we want to allow to our world. It depends on us with who we want to share our virtual space and who we want to meet there.

Love and belongingness needs - Examples of those are: friendship, receiving and giving affection and love. Affiliating, being part of a group (family, friends, work). In Neos VR and other social VR platform, you can create a community of friends, virtual relationships. Find new friends or love. It is possible to design spaces for meeting friends and family.

Esteem needs - dignity, achievement, mastery, desire for reputation or respect from others (status, prestige).
Now it is usual that virtual profiles have followers, high status, and prestige. Celebrities, models, influencers, actors, singers have rich online virtual profiles. It is also possible to have fans in the Neos VR platform in VR. Also, the type of architecture in VR is possible to design in a simpler way or more fancy fantasy way. An example is a villa or residence, the chateau in contrast to a simple family house in physical space.

Self-actualization needs - realizing personal potential, self-fulfilment, seeking personal growth and peak experiences. This category is more relevant in physical life than in virtual.

Elements of architecture in VR derived from architecture in physical space. Vitruvius Ten books of Architecture and Rem Koolhaas Venice Biennale Exhibition Elements in 2014.

Vitruvius

Ten books of Architecture are for me a perfect reference for architecture in VR . I selected chapters that are relevant for virtual reality spaces.

BOOK I / PREFACE THE EDUCATION OF THE ARCHITECT. THE FUNDAMENTAL PRINCIPLES OF ARCHITECTURE. THE DEPARTMENTS OF ARCHITECTURE. Education of architects in VR should be according to me in architecture and art, but also design computing and IT. Vitruvius stated that architects had to have an education in Arts and technical fields and science. As an architect for VR, should we also work with: Order (in Greek τὰξις), Arrangement (in Greek διὰθεσις), Eurythmy, Symmetry, Propriety, and Economy (in Greek οἰκονομὶα). We can design the VR worlds online with the arrangement and economy in NEOS VR. We can think of new types of functions, activities in VR online worlds and design that space according to this new function. We should design VR worlds with aesthetic ambitions, a similar statement that Vitruvius writes in his books. Different virtual worlds in VR can represent monofunctional but also multifunctional VR spaces.

BOOK II THE ORIGIN OF THE DWELLING HOUSE. ON THE PRIMORDIAL SUBSTANCE ACCORDING TO THE PHYSICISTS.
What was the first dwelling house? What was the first matter? We can ask: What was the first VR architecture? Maybe the one used in VR games or VR architecture used for first VR meetings. We can define new types of buildings, VR architecture for different actions, functions. What was the first matter in the virtual world? Well, there is no matter, just computer simulation.

BOOK III ON SYMMETRY: IN TEMPLES AND THE HUMAN BODY.
We can design a temple for meditation for praying in VR in any religion. Spaces in VR can be programmed and interactive. VR architecture can have multiple functions and be changeable. Avatars in VR worlds are usually in the size of the human body, but avatars can change the scale to giant and small sizes. It depends on how we set the avatar.

BOOK IV THE ORIGINS OF THE THREE ORDERS.
We can learn from Vitruvius. How to design architecture according to a body? The avatar's body can be different from a human. So, the proportions of VR architecture are less related to the human body. There will be some types of VR architecture, forex., implied by built structures, art, nature (like biomorphic VR architecture).

BOOK V THE FORUM AND BASILICA.
Vitruvius writes about harmony, theatres, music in architecture. We can add sound to 3D spaces in VR. There are parties in social VR network Neos VR, group gatherings of avatars who can observe in VR a video of opera. In VR, there are possibilities to design theatres. As architects, we can learn from public space in VR from this chapter. COLONNADES AND WALKS.

BOOK VI. HOW ROOMS SHOULD BE SUITED TO THE STATION OF THE OWNER.
As designers, we can create VR architecture for clients, for private or public use: FARMHOUSE, THE GREEK HOUSE. VR architects can learn from principles of built historical or contemporary architecture. But they should never copy built architecture.

BOOK VII FLOORS.
CEILINGS AND WALLS. All of them have similar attributes in architecture for VR. The floor's ceilings and walls can have material and texture. Vitruvius writes about materials and colours for painting walls and ceilings. VR architects can design materials and colours of VR architecture in a 3D program.

BOOK VIII
Water is also an element that can be made in VR but has only aesthetic importance.

BOOK IX THE ZODIAC AND THE PLANETS. THE PHASES OF THE MOON. Architects designing VR architecture should think about the universe and spacetime to add virtual time for new virtual worlds to coordinate meetings in VR for users of NEOS VR easily. VR architect creates virtual worlds, which means he sets up the gravity, sunshine, spacebox, another lighting. He builds VR architecture. He can add elements like water, fire, weather like a snowstorm, sandstorm, basically particle system elements.

BOOK X Defence type of buildings are not relevant in VR, but there exist some protections like you cannot go through a 3D object, or you cannot enter private VR worlds in Neos VR, you can invite some friend avatars to your VR world.

Elements

In the book Elements from 2014 Rem Koolhaas and his team are writing about the history of each element of architecture: Wall, Floor, Ceilings, Elevator, Façade, Roof, Floor, Door, Window, Balcony, Corridor, Fireplace, Toilet, Stair, Escalator, Ramp.
It is a very new approach to think about each element of architecture separately and give a compact knowledge about that element. In virtual reality, I can also focus on VR elements of Architecture for VR. Of course, the conditions like flying of avatars in VR or moving through 3D objects in VR requires different parameters.

Wall in VR can divide space, create intimate space. Wall in VR does not relate to the actual material, construction. We can give texture with many different colours and image that express what is hard to build in the physical world. The material in VR is a texture. There is no need to copy existing materials and their photos as a texture. Architecture in VR can be very colourful. Wall in VR can organize space but in different ways, because avatars can fly or teleport through walls in VR. We can also set up collisions in Neos VR so that avatars go through or set up by visual programming the interactive VR environment.

The floor in VR is something that gives the emotion of stability, security, closure. But for structure floors are not needed. Similarly, as walls in VR avatars can fly through, or we can set up in NEOS VR the type of collision with the 3D object. The floor can have the colourful texture that can express meanings that we give it as architects for VR. Floors mark the spot in VR space that we can stay for a while.

Ceilings can become floor from the other side with no thickness like in the physical world. This element can hang in 3D space. If ceilings and walls do not touch each other, it is not a problem. The element ceiling as well instead of the material can have the texture with whatever image. All elements can be as thin as a simple surface with no thickness because the bearing structure does not exist. Elevator changed the history of architecture because architects could design multi-storey buildings like skyscrapers. In virtual reality, the possibilities are endless because there is teleport. Teleport in Neos VR can have different speeds. If we set up a place in VR that has the power to teleport avatars faster to some other spot, we can call it elevator in VR.

Façade in VR can express the concept of the building in VR, can represent a statement, a billboard in VR. In some cases, we don't need façade at all in VR. Structure of the building can hang in space, float. The whole architecture can consist of not connected pieces, forms. Façade in VR doesn't need to have windows, glazing, doors, balconies.

Roof in VR is some indication of what structure we should consider as one building in VR. The roof element can have a thin surface and can have original texture.
I selected elements of architecture that in VR are not needed:
Door, Window, Balcony, Corridor, Fireplace, Toilet, Stair, Escalator, Ramp.

The door is not needed in VR because you can go through 3D objects like a wall. Window in VR is not used in VR because the structure in VR can be the open structure with voids, floating structure with openings.

The window in VR doesn't need to protect from outside weather, we don't need to open window for ventilation issues in VR.

The balcony is also not relevant I VR because there is no outside space, in VR conditions are the same as in a room with VR headset. The corridor is not needed in VR because avatars can fly through walls. The organization in space is different than.

Elements of Architecture in VR Derived from Architecture in Physical Space.
Rem Koolhaas and his team – Venice Biennale Exhibition Elements in 2014:

"WALL: THE VANISHING DIVIDE
providing structure and dividing space
contingent wall, organizing movement within the resulting container.
The former, it would seem, is a stable as the human need for shelter,
the latter as changeable as our forms of sociability…
Seen in time-lapse, the history of changing forms of civilization, as new segmentation of spaces is demanded by new forms of society. "

"FLOOR
…once a surface for symbolic expression – defining the way spaces are used, the "rules of the game" – floors in the 20th century tended towards a purely Cartesian surface, rational, undecorated, unloved, always perfectly flat, ideally soundless."

"CEILINGS
- traditionally iconographic, thin, and contiguous with the underside of the floor above – became exponentially thicker over the last 100 years...In some ceilings, thanks to BIM and sustainability engineering, these cumbersome systems begin to shrink, enabling the ceiling to become expressive again… "

"ELEVATOR
the introduction of the elevator ended an entire period of architectural history, and relegated another element-the stair-to a bit part role in buildings."

My statements:

Façade in VR could be element expressing aesthetic meaning, also cultural one or politic. Facade could create in image in VR that the client would wish, or architect want to express.
Roof in VR has no purpose to protect avatars from weather, also is not needed for structure. Roof in VR can cover some 3D structure and show that what is under the roof is related to the one VR building. These other elements mentioned in the books of Rem Koolhaas and his team are not relevant for Architectural Spaces in VR. Doors are not needed to open and go through spaces. Windows are not needed in VR, structure can have open voids, spaces, weather condition are not relevant. Balcony also not needed, there is no interior and exterior with different conditions. Fireplace not relevant, no fire in VR, toilet not relevant, avatars have no physical body. Stairs not relevant, different movements, flying in VR, teleporting, same reason with escalator, ramp and corridor. Of course, you can copy any element from physical architecture and use it in VR, but that is not the point of my study to create copies of existing architecture.

Selected architects from the 21st century who use design computing as architectural design process: Greg Lynn, students of Greg Lynn group, iheartblob.

I found a blog on Instagram created by Greg Lynn's students that are designing and exploring new objects, blobs. On their Instagram, they present renders from Unity, also augmented reality videos, overlaying existing real spaces. To me, this kind of experiments is ready to be transformed into virtual reality. Iheartblob is creating their projects in the Unity VR program. These blobs could become new architectural spaces for virtual reality accessible and visited by avatars in NEOS VR. Greg Lynn is the essential person for the development of computer-aided design in architecture. In the 90s he wrote a book about his projects designed in a computer called Animate Form. Greg Lynn saw the great potential in augmented reality technology for architects and promoted HoloLens in 2016. In Animate Form, Lynn explains the word animation and motion.

He suggests that *"animation approach to architecture subsume traditional models of statics into more advanced systems of dynamic organizations. Traditionally, in architecture, the abstract space of design is conceived as an ideal neutral space of Cartesian coordinates."*

In NEOS VR, I am moving in the metaverse, motion is essential here to navigate in the space, but also other 3D objects can move and change the volume. We have a chance to get rid of the responsibility with the statics of the structure. We can let the architectural space for a virtual reality be animated and in motion. In VR it is all possible. The term virtual Lynn explains as referring to the digital environment and computer-aided design. What is the difference between Architectural Space for Virtual Reality and architectural space in reality? Architectural space can be designed and constructed without computers, but Architectural Space for Virtual Reality is computer simulation by numbers that cannot exist without machines. Computers are not only helping to design the space. The computers make it possible to experience the virtual space. Lynn uses term virtual reality as a simulated environment. He uses "simulated reality" or "substitute reality", he writes about virtual descriptions:

"Since architects produce drawings of buildings and not buildings themselves, architecture, more than any other discipline, is involved with the production of virtual descriptions." (G. Lynn 1999)

We are now the ones who will design metaverse and the main difference is that we have the chance to design exactly the objects in 3D in VR.

Architects from 20st century who explored architectural utopias and fantasies.

In MoMA, there was an exhibition in 2008-2009 about New York plus other locations focused on experimental and utopian architecture since the 1970s. I love the plan of Dreamland (1977) and the drawings of the book Delirious New York (1978) by Rem Koolhaas and Madelon Vriesendorp. *"The explosion of architectural thought and experiments that took place in the 1970s resonates to this day. Raimund Abraham, Peter Eisenman, Rem Koolhaas, Steven Holl, and Hans Hollein are among the well-known architects practising today who are inextricably linked to both the practice and theory of the 1970s. Dreamland features the architectural process of rendering visions and dreams that, in some cases, are made real. In addition to the Koolhaas drawing, other recent acquisitions in the exhibition include works by Diller + Scofidio and Simon Ungers. "*(MoMa, 2008).

Utopian projects of cities of 20th and 21st century.

Buckminster Fuller – Dome Over Manhattan 1960

I choose this project from 1960 because of an experiment to close a city into a dome structure. Buckminster Fuller Dome Over Manhattan is testing the idea to build a climate-free city. There would be with no rain, no snow inside the dome. In Virtual reality, there is also a climate free environment, because you experience the VR inside of the existing building. In that sense, a virtual city is also a similar topic.

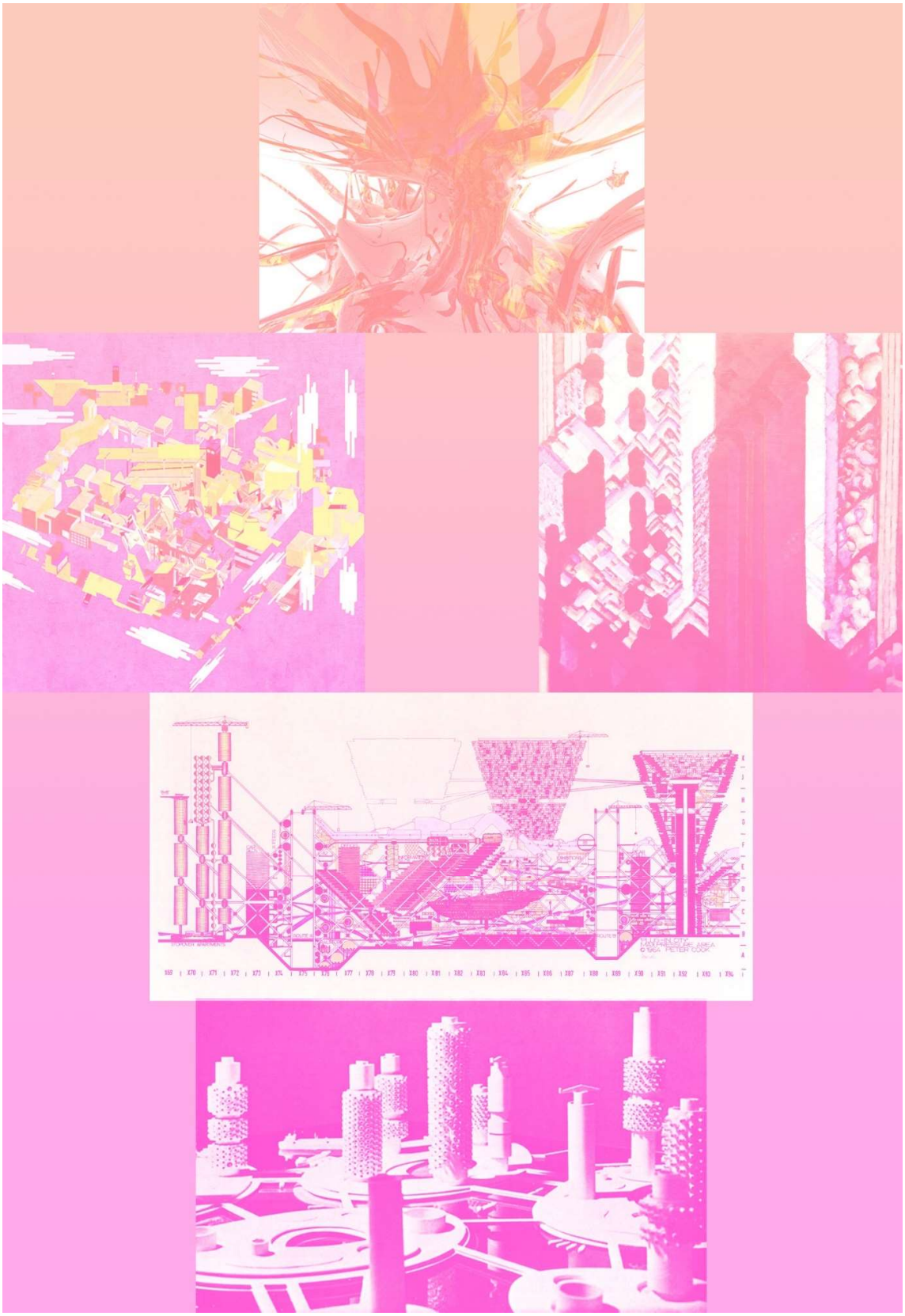
Yona Friedman -Bridge City 1960

The Bridge City by Yon Friedman and Eckhardt Schultze-Fielitz was the bridge over the English Channel. They filled this megastructure by residential, commercial, and industrial units. These units are inserted into this structure when they are used and needed. There is also a hotel, artificial beaches, rail, highways, ports. I see similarities with creating architectural space in VR. In NEOS VR, when you design a VR world, the world exists when it is used and occupied. In a VR environment, you can have all functions mentioned above, but those space will serve only as a virtual background, but that is also important for me.

Paolo Soleri – Mesa City 1960

Mesa City by Soleri reminds me of a structure growing like mushrooms and plants from the ground. What is interesting is how this architecture is more weight on the top than at the bottom. These megastructure compounds feature a residential and academic complex, administrative and public functions. The structures reach 1000meters. In VR, you could fly around these structures and teleport yourself to different levels.

IMAGES FROM THE TOP: MARKÉTA GERBIAN - EMOTIONAL SPACES. AT THE BOTTOM RIGHT: IHEARTBLOB - HOFBURG PALACE.



IMAGES FROM THE TOP: OLIVER MITCHELL - NEW COLOUR EXPERIMENTS, VIDEOGAMEURBANISM - BARTLETT SCHOOL OF ARCHITECTURE, FRANTIŠEK KUPKA - LA CATHÉDRAL, PETER COOK - THE PLUG-IN CITY, KIYONORI KIKUTAKE OCEAN CITY.

Kiyonori Kikutake - Ocen City 1960

Ocen City by Kiyonori Kikutake was a Metabolist proposal for a floating city of two concentric rings. The inner part has residential uses. The outer ring is an industrial zone. The innermost islands are for communal purposes. The area between is reserved for the cultivation and production of special sea-products, while the meeting point of the rings provides a space for administration and planning centre. The city has a 'control tower', a place of communal administration and planning centre. There were other exciting projects from Japanese Metabolist architects like Kenzo Tange and his project Tokyo Bay, Kisho Kurokawa with Helix City or Arata Isozaki with Clusters in the Air.

Archigram - Plug-In City, 1964

"Plug-in City is visionary creations produced in the 1960s by the radical collaborative British architecture group Archigram, of which Cook was a founding member. A "megastructure" that incorporates residences, access routes, and essential services for the inhabitants, Plug-in City was designed to encourage change through obsolescence: each building outcrop is removable, and a permanent "craneway" facilitates continual rebuilding. Between 1960 and 1974, Archigram published nine provocative issues of its magazine and created more than nine hundred exuberant drawings illustrating imaginary architectural projects ranging in inspiration from technological developments to the counterculture, from space travel to science fiction. The group's work opposed the period's functionalist ethos; Archigram designed nomadic alternatives to traditional ways of living, including wearable houses and walking cities—mobile, flexible, impermanent architecture that they hoped would be liberating." (MoMA 2012).

Then the Superstudio had a project Continuous Monument, Rem Koolhaas Exodus. These utopian and visionary ideas were a significant topic in the sixties. Architects predicted spatially fantastic structures and cities that by that epoche were impossible to construct. Even today it would be impossible to realize projects like walking city. But what could be possible to get inspired by those projects and create architectural and artistic space for virtual reality? Today many IT specialist designs environments for the gaming industry. Some architects are involved, but in my opinion, it is not enough.

Research of current student projects at AA and Bartlett School of Architecture.

The student from Bartlett created an Instagram account with the hashtag #videogameurbanism. Student of Bartlett designed Videourbanism projects, not for construction, but only virtual existence. Another young architect educated in Bartlett School of Architecture UCL creates exciting 3D spaces, environments. Oliver Mitchell. He works in the VFX film industry and has a unique and current understanding of digital design. Film industry with their fantasy films is very close to game design and design of social VR platforms environments.

Selected artists and their artworks from the 20th century focused on the interpretation of architecture, cities: František Kupka, Zdeněk Sýkora, Maria Helena Vieira da Silva.

František Kupka

His interpretations of architecture were impressive abstract structures painted on canvas. His painting, Reminiscence of a Cathedral 1920 creates the illusion of vertical space with floating small spaces around. With today´s VR technology, we can redo this work into architectural and artistic space for virtual reality.

„Kupka developed a unique path to pure abstraction. He combined his interests in Orphism, an offshoot of Cubism that focused on simultaneous colour contrasts as equivalents of musical pitches, Slavic folk art, the decorative art of Islam, and new scientific inventions such as radiography. Theosophy—a synthesis of philosophy, religion, and science—also guided Kupka's approach to art. Additionally, he studied the stained-glass windows of the Notre-Dame cathedrals in Paris and Chartres. Kupka's desire to capture the feeling of light passing through coloured glass led to several compositions on this theme, including Reminiscence of a Cathedral. "

(Art Institute Chicago)

Zdeněk Sýkora

Zdeněk Sýkora is known for his innovative way of how he used computers for the creation of his paintings. Ladislav Daněk said in his video about Zdeněk Sýkora that Sýkora was one of the first artists who used computers for creating the compositions of his paintings since 1963. Sýkora used the computer as a machine, but Sýkora also used his intuition of an artist.

Maria Helena Vieira da Silva ,

was born in Lisbon, she was a Portuguese abstractionist painter. She was part of an artist group that we call Art Informel. When I visited Árpád Szenes-Vieira da Silva Foundation in Lisbon, I was amazed by the topic of her paintings, the interpretation of cities. She interpreted New York or Amsterdam, many times also Paris, where she also lived.

Sa Silva used the illusion of perspective in some parts of the images the painting looked flat. But when I looked at Silva's artwork, I could see some part of the city. In some cases, I would compare da Silva's paintings to Zaha Hadid early works. But of course, da Silva had a more abstract and blurred way of interpreting cities. Now I will present my designs, case studies that are my interpretations, Architectural and Artistic Spaces for Virtual Reality.

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IMAGE BY MARKÉTA GEBRIAN - MAGIC FLOWER, RENDER FROM RHINOCEROS, 2016.

CASE STUDY I. Title:
MAGIC FLOWER

Type of results: Digital 3D model in Rhinoceros, renderings, digital collages, my first 3D object in virtual reality and my video as a screen capture in VR. Functional virtual reality world with 3D object Magic Flower in NEOS VR. NEOS VR is a creative social VR online platform. Anyone can visit NEOS VR online in the body of avatar in virtual reality.

Topic: I wanted to create imaginary fantasy worlds with organic shapes and the small 3D object that would be in the size of the tall gallery room. I wanted to test spaces that are not possible to inhabit. I designed organic shapes without the floor and roof where you can fly around just like an insect around the flower. From that, I derived the name Magic Flower.

Dimensions: 3D model is about 10m high to 17m large.
For exact dimensions, please see attached images.

Technique: I built a 3D model according to inspirations from the garden of the film Alice in Wonderland from Tim Burton. I wanted to create cocoons for private communications of avatars in VR, so I designed closed intimate shapes. These shapes are related to the cocoons of butterflies. I made many digital renderings and from them digital collages with the 2D background in 2016. In 2019 I learnt NEOS VR. I exported the 3D model from Rhinoceros in FBX format into NEOS VR. I had to set up the position and rotation of the model in my new virtual world in NEOS VR. I had to upload the textures again in NEOS VR and place them on the 3D model in NEOS.

Year of creation: 3D model in Rhinoceros is from 2016, functional model in the virtual world in NEOS VR is from 2019.
Task: To test inhabitable organic spaces and transform them into virtual reality. To design a 3D object with textures in virtual reality in a small size and export 3D model from Rhinoceros into VR. The first attempt was with the help of MSF Digital VR office. In 2019 I worked with NEOS VR program and created an online virtual reality world myself.
Location of the Project: Virtual gallery in 2016, space in virtual reality in NEOS VR in 2019.

Reference to the Books:

1950 Ray Bradbury The Veldt.
"The author tells the story of the family living in an automated house. The children have their virtual reality room that can reproduce any place they imagine. Bradbury develops the scenario of a spatially immersive illusion that can be realized without technologies." (Ars Electronica Festival 2018). For me, it is almost like entering a dream. That is what now technologies and NEOS VR can do. My project Magic Flower is also an object inside the virtual world, where you can fly in VR in my imagination and experience unexpected shapes and spaces in Magic Flower.

Inspirations by shape and colours:

Butterfly cocoons.

Since my childhood, I was fascinated by butterflies and their cocoons. I wanted to express the intimate space by experiencing such a cocoon is around you. Butterflies' cocoons inspired me for the shapes of my Magic Flower.

Coral reefs.

I have been a scuba diver since 1999. Whenever I got a chance, I dived in the ocean to observe corals. It is pure joy and happiness for me to float and dive in the water and see different shapes and colours. This experience influenced my design.

Fashion by Iris van Herpen.

Iris van Herpen collaborates on some projects with architects and, they work with 3D printing. Her designs are unique and somehow architectonic. She works with the topic of cocoons as well.

Inspirations by fantasy worlds.

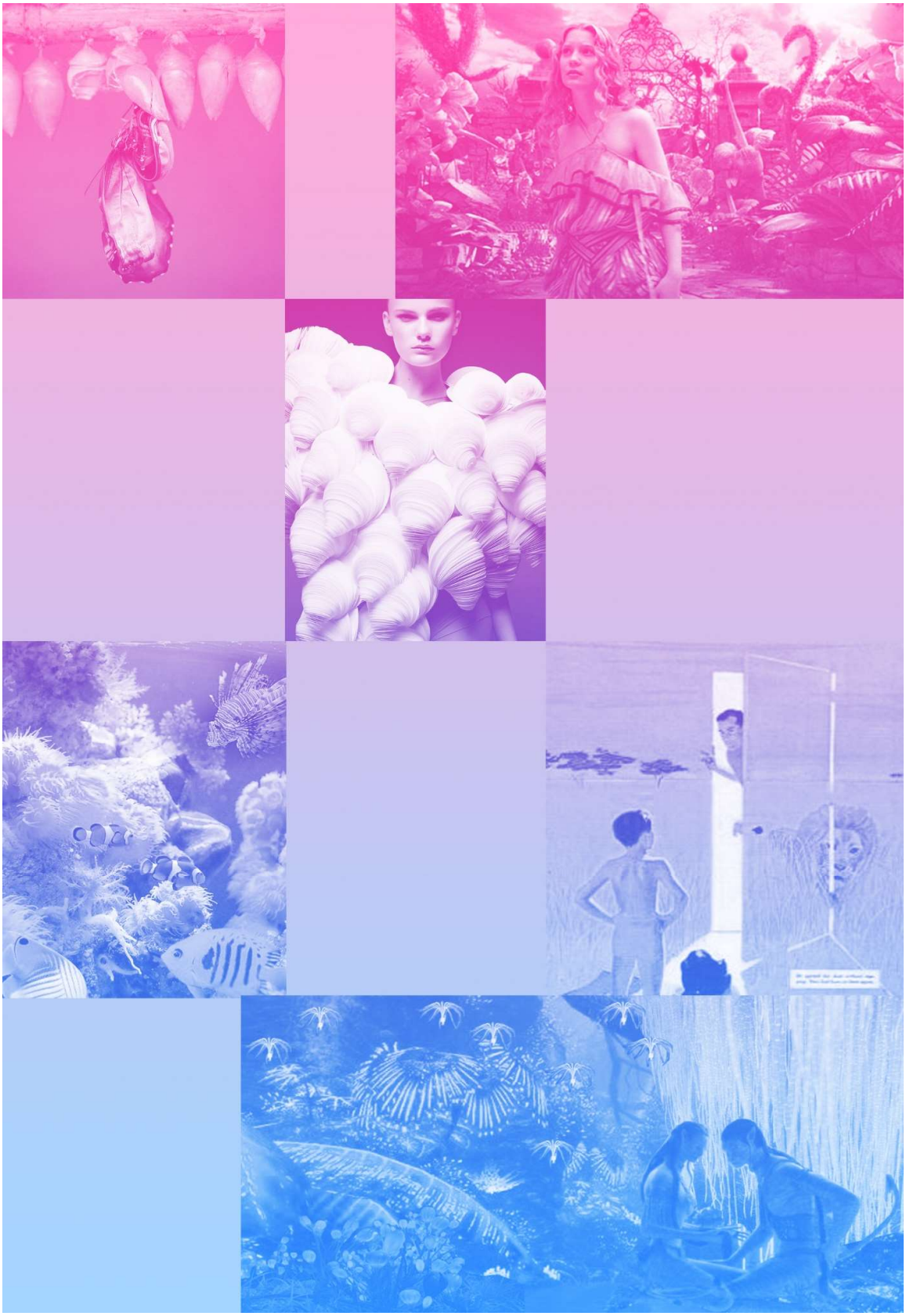
I love the film by Tim Burton, Alice in Wonderland. Especially the visual concept of fantasy garden where flowers are taller than humans and can talk. I love the way the flowers have this scale. I wanted to explore the fact that cocoons would speak even in the NEOS VR. Another hit film was AVATAR, directed by James Cameron from 2009. I loved the colours, shapes, and fantasy nature of the planet Pandora. Also, the concept of avatar body and living in different reality was exciting to me.

References to Architecture:

Anish Kapoor, Arata Isozaki - Ark Nova 2013.

"Sculptor Anish Kapoor and architect Arata Isozaki have teamed up to design and build the world's first large-scale inflatable concert hall in Tohoku, Japan. The mobile structure, called Ark Nova, was designed not only as a venue for concerts and events but also to spread hope throughout the northeastern part of Honshu, which has been ravaged by earthquakes and tsunamis." (Lidija Grozdanic). This air-inflated membrane structure reminds me of the space inside my cocoon in VR. The membrane of the concert hall is foldable. In this project, I appreciate the colours and shapes of this concert hall and the inflatable structure that could make us feel special.

"Conceived as a mobile, inflatable auditorium with a 500-person capacity, it brings music and art to the Tohoku region with the hope of healing psychosocial traumas. According to the organizers, Ark Nova, meaning new ark, takes inspiration from the biblical narrative of the great flood and Noah's ark. The ark is also inspired by the ancient Japanese notion of morabito— "sacred guests" who arrived from foreign lands with special religions or festivals that rejuvenate society. Like the mythical Noah's ark, Ark Nova is intended as a symbol of renewal and recovery after a tremendous disaster. It is a visitor bringing those vital elements out of which culture is periodically composed and recomposed—namely,



IMAGES FROM THE TOP LEFT: BUTTERFLY COCOONS, ALICE IN WONDERLAND FILM BY TIM BURTON, IRIS VAN HERPEN DRESS, CORAL REEF, RAY BREDBURY THE VELDT, AVATAR FILM.

music, dance, improvisation, and ritual interaction. The mobile architecture is a result from the collaboration between the Indian-born British artist Anish Kapoor and the Japanese architect Arata Isozaki." (Tan l.)
I think that architecture should have the aspiration to give hope or to heal. In the past those kinds of spaces were sacral buildings, churches, but why not give this hope in architecture like a concert hall.

Zaha Hadid – The Winton Gallery - Science Museum UK 2014-2016.

"Mathematics also defines Zaha Hadid Architect's enlightening design for the gallery. Inspired by the Handley Page aircraft, the design is driven by equations of airflow used in the aviation industry. The layout and lines of the gallery represent the air that would have flowed around this historic aircraft in flight, from the positioning of the showcases and benches to the three-dimensional curved surfaces of the central pod structure" (Zaha Hadid Architects).
This project by Zaha Hadid is also exceptional because of the colours, lights and construction that is inspired by equations and mathematics. In virtual reality, everything is a mathematical construct. We create in VR, the illusion of 3-dimensional space by using points with cartesian coordinates. Each point in VR has some coordinates represented by numbers. Then this point can move, be scaled, be rotated in these cartesian coordinates. The computer must recalculate each point every time something has changed. For these types of calculations computer use matrices. Virtual reality is a construct based on numbers.

Reference to the Architectural Materials:

Philip Beesley - Aurora 2013.

During the first experiment, I was thinking about constructing my Magic Flower as Smart Structures like Philip Beesley in his project Aurora. But I realized that virtual reality would give me more freedom in creating designs, environments, and architectural spaces for virtual reality. Philip Beesley creates a permanent installation for the interior in West Edmonton Mall. Aurora takes its inspiration from the aurora borealis.
"The sculpture is composed of hundreds of thousands of individual components including laser-cut stainless steel, acrylic and mylar, densely massed glass vessels, and custom computer-controlled circuitry. Aurora will create an ethereal overhead canopy designed to gently swell and ripple in an ocean of intelligent LED lights that responds to viewers gathering below." (Philip Beesley)

Reference to Experimental Architecture:

iheartblob 2018.

…." We believe the clocks of Newtonian physics have been blurred by the clouds of quantum theories,

IMAGES FROM THE TOP LEFT: ZAHA HADID - THE WINTON GALLERY, PHILIP BEESLEY. - AURORA, IHEARTBLOB - GOLDEN GATE PARK, ANISH KAPOOR, ARATA ISOZAKI - ARK NOVA.

*and whether we consider biology, philosophy or architecture nothing is set; everything can change." I love this sentence: **"nothing is set, everything can change"*** … (iheartblob).
Because that is what I am trying to do, design the metaverse. We have now endless possibilities to shape the virtual future and offer a new type of spatial experience to human avatars. Avatars can fly or float around architecture in virtual reality, just like around some giant statue. Architectural space and artistic space are blurred.

References to Art:

Zdeněk Sýkora - Lines - 1974.

"Zdeněk Sýkora worked with computers to create amazing painting since 1963. He used for the composition of his painting's computer model. Since 1974 Sýkora started to create' Lines' paintings, he did his work with the help of computers, but Sýkora used his artistic intuition as well. Sýkora painted his artwork by hand." (Ladislav Daněk)
I think that artist Zdeněk Sýkora is the pioneer for contemporary Digital art, Cyber art or Generative art. Amazingly, Sýkora used the computer so early in the 60. The computer can be a source of inspiration for the work of artists and architects. We can create and design spaces together with computer because that is what can make our proposals unexpected and extraordinary.

References to Scenography:

Josef Svoboda ĽOiseu de Feu - 1972.

Genius scenographer Josef Svoboda designed a scene for ĽOiseu de Feu in 1972. He used lights, textured triangles to create changeable emotive space, that was the play of colours, lights and shadows. *"The massive spatial structure floated above the stage in the fairy-tale ballet of Igor Stravinsky's Bird of Fire (prem. 11.11.1972) in Det Kongelige Theather in Copenhagen. Choreographer and director were Eske Holm. The structure consisted of many small triangular surfaces. The volume of the structure was multiplied by a 15x15m mirror placed above the scene. The mirror had the accurately calculated slope related to the light projection. The principle was based on additive lighting, which means that on each surface was directed projection by three projectors, they had red, green and blue filters."* (Helena Albertová)

References to Cyber Art:

1992 Home of Brain

The interactive art using virtual reality is an installation by Monika Fleishmann and Wolfgang Strauss. They presented an imaginary museum, which visitors can explore and discover with an "EyePhone" system, a product of VPL research. The imaginary museum that has virtual objects inside was my inspiration, plus the title. What you have in your brain you express in VR. *"Home of the Brain" stands as a metaphor for a new form of public space. It becomes the centre for cultural reflection of the new technologies. The architecture is combined with contradictory opinions and philosophical views, which transform the virtual environment into a symbolic space. We join different standpoints under a*

IMAGES FROM THE TOP LEFT: ZDENĚK SÝKORA- LINES, JOSEF SVOBODA – L'OISEU DE FEU, HOME OF BRAIN, SECOND LIFE.

common roof - a debate between the most widely diverging views, a symbolic dispute between argumentative spirits." (Monika Fleischmann, Wolfgang Strauss)

Reference to Social VR platform:

Second Life 2003
Dreams of Sci-Fi authors came true in 2003. It is an online world full of freedom where you can choose an avatar who another life with you and you can configure your world your way. This project is still alive today.
Fantasy nature from this online Second Life influenced by shapes and colours. I loved the idea of using the social platform and the public but virtual environment. In 2019 when I started to work with NEOS VR, I realized that it is possible to design those virtual architectural and artistic spaces for virtual reality. The Second Life, in 2003 was a social VR platform, but it was not possible to create your virtual worlds there.

Design:

Design Process: Step one – I was the be inspired by film Alice in Wonderland, the magic garden. I wanted to create structure, 3D object that would look like a massive flower and avatars in virtual reality would fly around like insects. I used stems instead of flowers on top. I designed cocoons. The reason was that cocoon can offer an intimate space. The situation when the butterfly is waiting to come out. Isolated rooms in the cocoons are small. Rooms contrast to the open spaces around the Magic Flower. Because we are in VR, flying avatars can inhabit all those spaces.

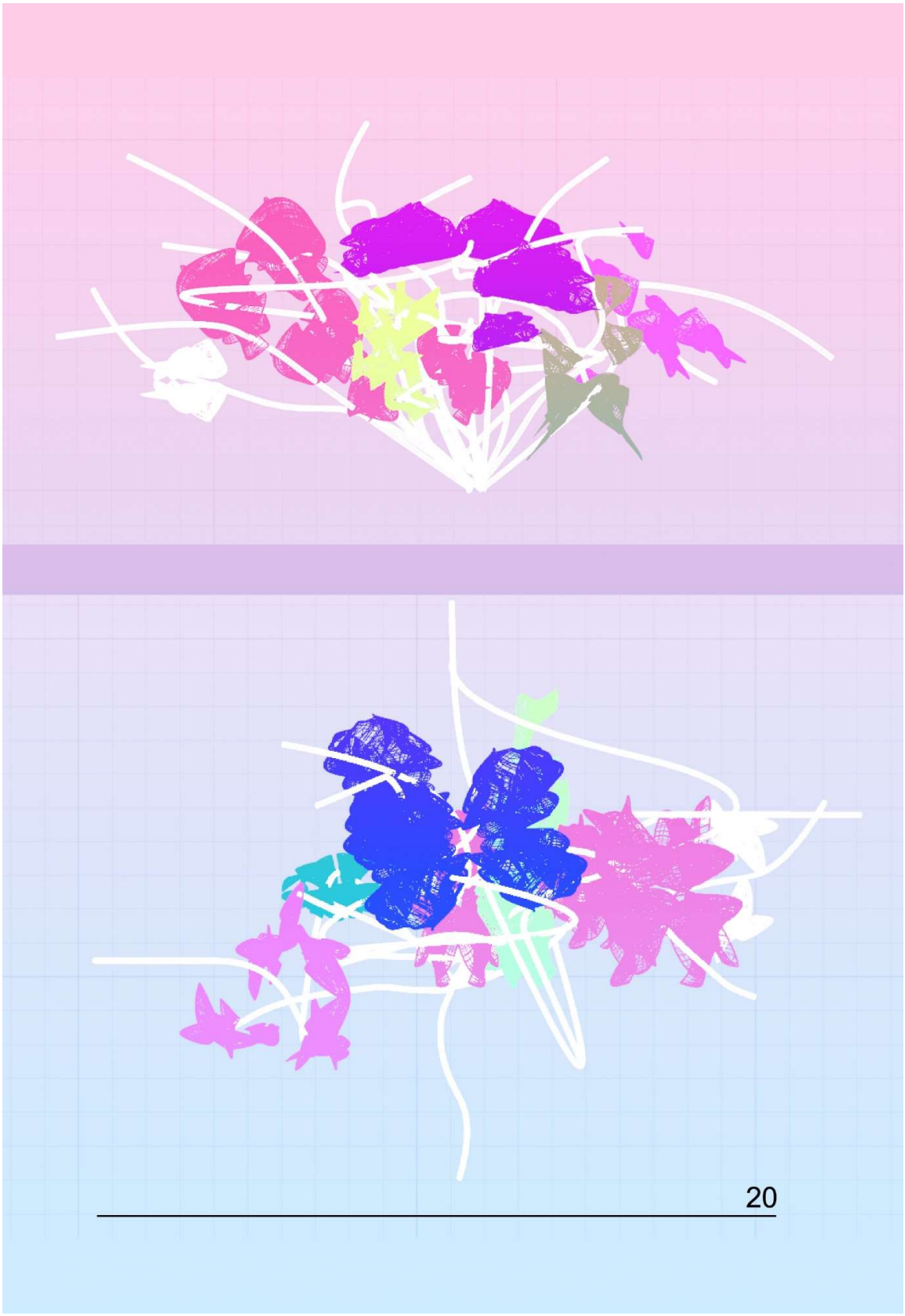
Structure: Stems and cocoons, Cocoons are constructed from surfaces by using loft from closed polylines.

Colours: simple grey stems and colourful cocoons like blossoms. I used my textures for cocoons from my previous artworks, 2D digital collages. Each digital collage has it' s own personal story that is inspired by my life and dreams.

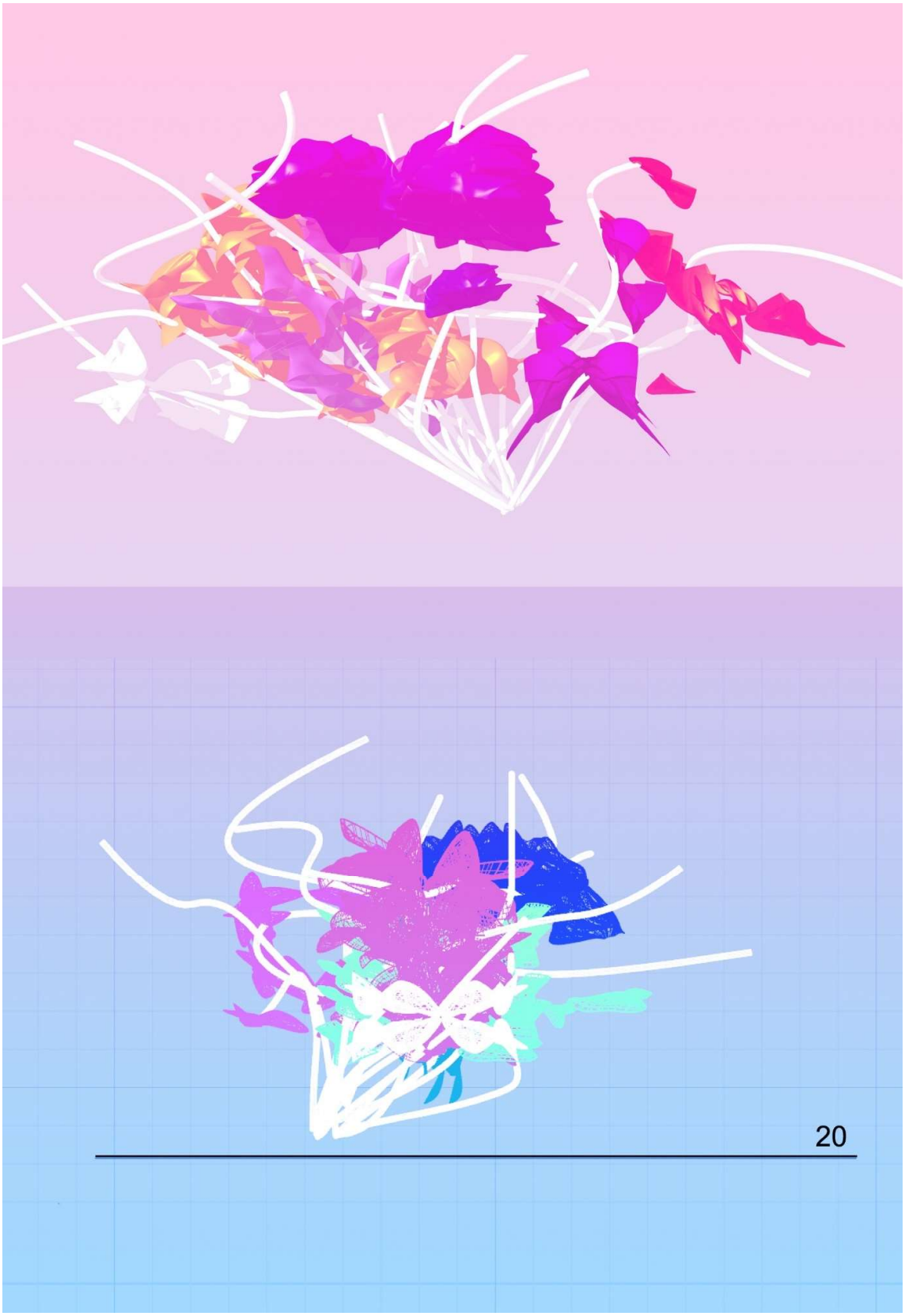
Composition: I designed one magic flower that grows from almost one spot.

Size: I wanted the size of the flower to fit into a virtual gallery in the size of a large room. I redraw a shape of the cocoon of a butterfly in Rhinoceros. I created surfaces from closed boundaries using the loft command. I duplicated, transformed, distributed and positioned the cocoons. I designed stems for cocoons to relate them to the ground. I textured cocoons. I worked with colourful textures to imitate the colourful magic garden. I worked in 2D with the renders, and I created digital collages.

Evaluation: I wanted to design spaces, capsules, cocoons that would be inhabited by avatars in virtual reality. I simplified the complicated 3D model, digital artworks and collages that I was creating before. I wanted to explore the export of Non-uniform rational basis spline (NURBS) and mesh geometry into virtual reality. It was a long process for me. In 2016 when I created the first 3D models in Rhinoceros, the NEOS VR was not yet developed and ready to use. The NEOS VR course started in February 2019 at the Faculty of Information Technology, CTU Prague. For me, it was adventure and dream-come-true, because I could suddenly enter and immerse myself my digital visions and dreams.



IMAGES FROM THE TOP: MARKÉTA GEBRIAN - MAGIC FLOWER - RHINOCEROS DRAWINGS, FRONT AND TOP VIEW, BOTH IMAGES FROM 2016.



IMAGES FROM THE TOP: MARKÉTA GEBRIAN - MAGIC FLOWER - RHINOCEROS DRAWINGS, PERSPECTIVE AND RIGHT VIEW, BOTH IMAGES FROM 2016.

IMAGES FROM THE TOP: MARKÉTA GERBIAN - MAGIC FLOWER WITH FANTASY BACKGROUND, 2D COLLAGES FROM RENDERS FROM RHINOCEROS, 2016. ON THE FOLLOWING PAGES: MAGIC FLOWER - PRINT SCREEN FROM NEOS VR, 2019.

"Virtual reality environments have long been used in studies related to architecture simulation…According to Ijsselsteijn and Riva (2003) "as user experience, the feeling of 'being there', or presence, is not intrinsically bound to any specific type of technology - it is a product of the mind".

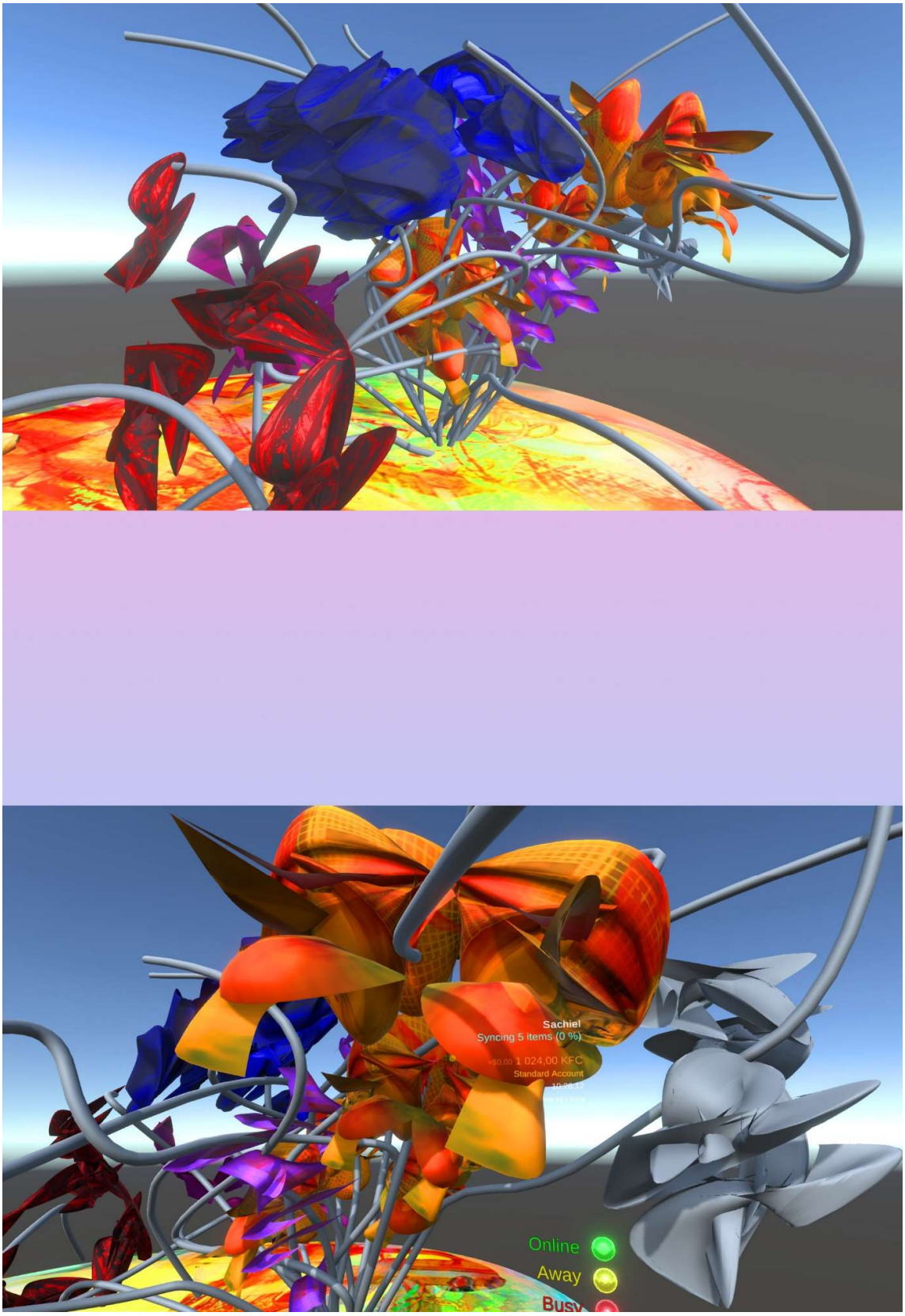
Following this approach Jurnet, (2005) investigated the human factors involved in the engagement of presence and the individual differences... Baños (2012) compared two different virtual environments, or media content, to assess if virtual environments would increase positive emotions and decrease negative ones while a high level of presence was being felt. Further work of this group investigates the presence between virtual and imaginary environments (Baños 2005). In this study, the authors concluded that participants in the virtual environment had a higher degree of the present than in the imaginary environment and that VR helps users to stay in the virtual environment over time although the presence in the imaginary world is not of long duration." Eloy, S., Ourique, L., Woessner, U., Kieferle, J. & Schotte, W. (2018).

For me, this case study concludes that the best solution is to design virtual reality environments for social VR platforms like NEOS VR because there you can meet other avatars and communicate with them, relax, study or work together. That would make me feel to stay longer in virtual environments with human interaction.

Summary:

I must continue to test large scale 3D models in the virtual city. In the architectural environment. I want to interpret the architectural spaces of cities into architectural and artistic space for virtual reality. If I add a new 3D object into some copy of the existing site, it is just collage of places, but not my interpretation.

My goal is to design a new type of architectural and artistic space in the metaverse, the Architectural and Artistic Space for Virtual Reality, VR Architecture.



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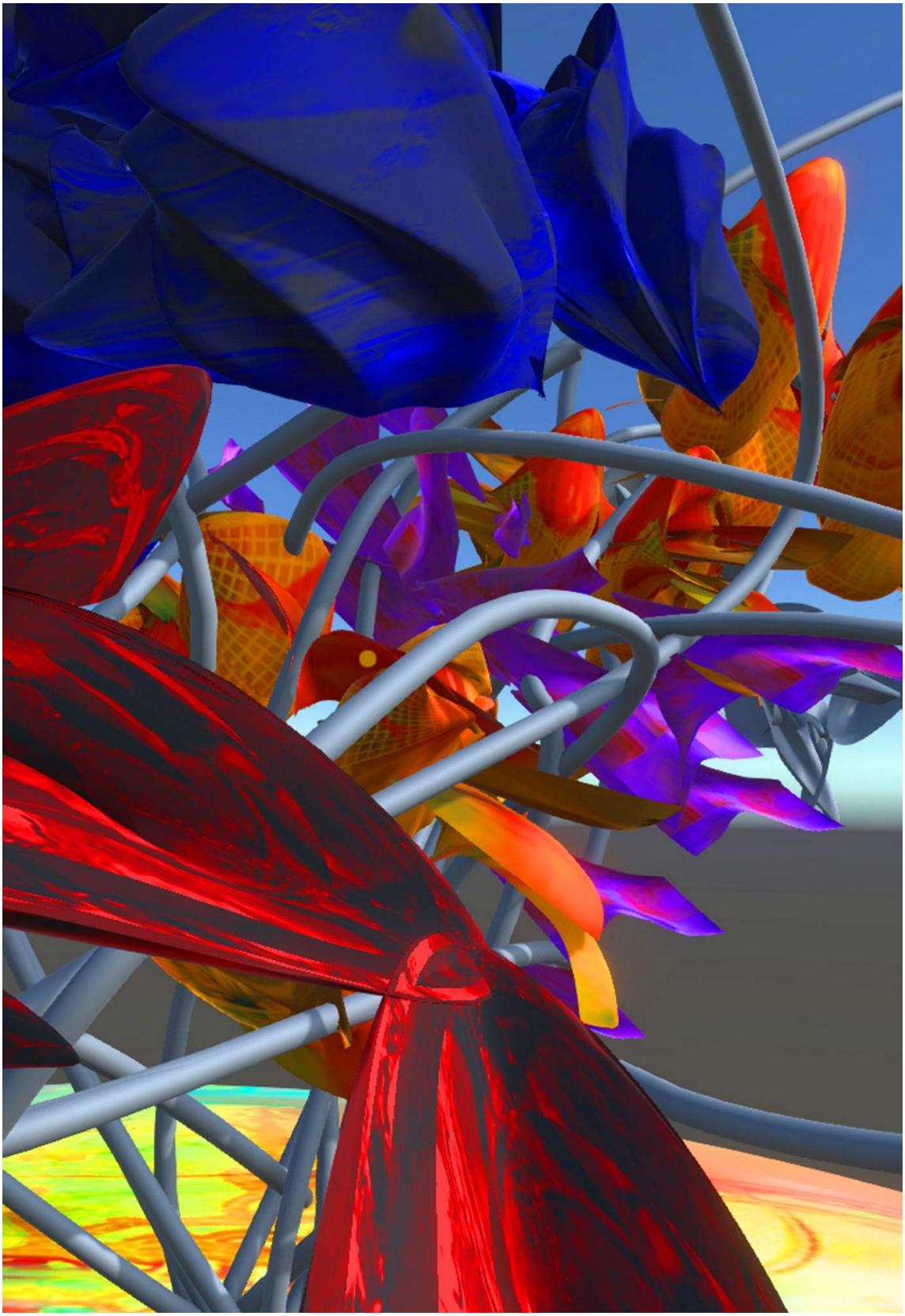


IMAGE MARKÉTA GEBRIAN - MAGIC FLOWER IN THE METAVERSE NEOS VR, PRINT SCREEN, 2019.

IMAGE MARKÉTA GEBRIAN - FLOWER IN THE CITY IN THE METAVERSE NEOS VR, PRINT SCREEN, 2019.

CASE STUDY II.
Title: COCOON FLOWER IN THE CITY

Type of results: digital 3D model in Rhinoceros, renderings, digital collages, 3D model of the computer-generated city and massive flower cocoon statue in Blender, animation in Blender: https://www.youtube.com/watch?v=gOjIfhwnvbE
The following result is the functional virtual reality world with a 3D object of the large flower growing from 3D computer-generated city in NEOS VR. NEOS VR is a creative social VR platform that anyone can visit online in the body of avatar in virtual reality. Cocoons in the animation from Blender are moving, floating in the sky. I didn't transform this type of movements into NEOS VR yet.

Topic: To test tall fantasy cocoon structure existing in the context of computer-generated architecture. This case study is about how we feel in the body of an avatar in heights about 300 meters. In human life, we rarely get the chance to experience living in an attitude like this. We cannot inhabit the sky every day like it is possible in virtual reality. The 3D object Cocoon Flower would have similar height as a wind turbine in Gaildorf in Germany 264m. I designed organic cocoons without the floor and roof where you can fly around and spend some time inside these giant cocoons that are floating in the virtual sky. The difference between the first case study Magic Flower and Cocoon Flower in the City is mainly the scale and the experience of an avatar seeing different perspective from above the virtual city. Gigantic cocoons are spaces where avatars can meet, relax, but mainly communicate together.
Dimensions: 3D model is about 264m high to 401m large.

Technique: I built a 3D model according to inspirations from the first case study Magic Flower. I wanted to create cocoons for group communications of avatars in VR. These cocoons float in the sky. I worked on the 3D model in Rhinoceros after, I exported the model to Blender. In collaboration with architect Jindřich Ráftl and his animation team and Marek Kulkovský, the VR expert we created the final short film in 2016. In 2019 I learnt NEOS VR, I exported the 3D model from Rhinoceros in FBX format into NEOS VR. I had to set up the position and rotation of the model in my new virtual world in NEOS VR. I had to upload updated textures again in NEOS VR and place them on the 3D model in NEOS.

Year of creation: 3D model in Rhinoceros is from 2016, Blender 3D model is from 2016, the animation is also from 2016. Functional model in the virtual world in NEOS VR is from 2019.

Task: To inhabitable huge organic spaces and transform them into virtual reality. To design a 3D object with textures in virtual reality in a massive size and export 3D model from Rhinoceros into VR. The first attempt was to export the 3D model into Blender and with collaboration with Jindřich Ráftl and consultation with Marek Kulkovský we created animations and video with the title Green Traveling. The idea was that in the future people will travel in virtual cities and that people will not need to travel in the real world to meet someone. So, it is the ecological green way of travelling in the future. In 2019 I learnt NEOS VR program, and I designed with new textures online virtual reality world myself.

Location of the Project: Virtual computer-generated city in Blender in 2016, a computer-generated city in virtual reality in NEOS VR in Metaverse in 2019.

Reference to the Books:

1964 Simulacron -3

"Was a book (also published as Counterfeit World), by Daniel F. Galouye, is an American science fiction novel featuring an early literary description of a simulated reality. Daniel Galouye describes a virtual metropolis used for market research. The city's inhabitants possess independent, individual consciousness, but they are unaware, except for one, that they are only electronic impulses in a computer, their world exists only in virtual space. The person who computer-simulates the city progressively grasps that his world is probably not "real" and might be only a computer-generated simulation." (Ars Electronica Festival 2018)

Simulacron-3 presents a simulated reality that could replace our reality. In my opinion, we should not be afraid of virtual lives, because we know where the boundary is between real and simulated. Also, the environment in virtual reality needs to be very different from real life. But this book shows this idea of virtual existence for the first time.

1992 Snow Crash

"In his novel, ***Neal Stephenson presents the Metaverse****, how he envisions the further* ***development of the Internet into virtual space.*** *Users represent by* ***avatars that populate the Metaverse****, to which humans flee from a reality in which large corporations have sized power and governments exist only symbolically.* "(Stephan Doesinger, 2007). In NEOS VR when we open the program, it says initializing the METAVERSE. The question still is who will design the Metaverse? Programmers and IT specialist are great in making the virtual digital worlds work in virtual reality. IT specialist and programmers for VR are not educated in architecture and design of spaces. They don't have an artistic background. People in real-world experience architecture and built environment and of course these existing buildings are also inspirations for designing the Architectural and Artistic Space for Virtual Reality. We, architects, designers and artist together with IT professionals, we can create the Metaverse that can offer huge imaginary spaces even if we are learning from the real world.

Inspirations by shape and colours:

From my first case study Magic Flower, I took a lot of inspirations like shapes of the butterfly cocoons and huge stems. In this case study, I wanted to test some exciting textures for the massive cocoons. I realized that idea in NEOS VR in virtual reality.

Inspirations by fantasy worlds:

1973 World on Wire

Rainer Werner Fasbinder two-part mini-TV-series Word on Wire is the first film based on novel Simulacron-3. Everything turns out to be a simulation.

1999 Matrix

Matrix is a famous movie that shows the idea that people live in a computer-simulated environment, and they are slaved by machines. I can remember that film opened for me a new topic of virtual reality. But the concept was like Simulacron-3. People are not conscious of their simulated nature and that they must fight against those machines who rule the world.

2018 Ready Player One

A film about the world in the year 2045, there exists a game OASIS, the virtual reality space filled with hundreds of virtual worlds with gaming activities, as well as a platform for socialization and commerce. People live in slums and spend most of their time in virtual reality. Players are trying to win a competition, the first prize money from the founder of Oasis. This film is an inspiration for me because of spaces like in the picture, the music club with flying would be fantastic.

References to Architecture:

Paolo Soleri - Mesa City 1960

"*Paolo Soleri is best known for his unbuilt projects: his pioneering conceptual designs of maximal sustainable mega population cities, for which he has coined the term arcology, signifying the fusion of architecture and ecology. At around fifty years old, after many years of experimenting with hands-on artisanal and building techniques, drafting bold urban-scale complexes, and defining his philosophical ideas, Soleri burst into broader public attention with two signal events: the publication of his ground-breaking book, Arcology: The City in the Image of Man (1969), and a major exhibition that showcased his work at the Corcoran Gallery of Art in Washington, DC, in 1970.*" (Lissa McCullough 2012) Mesa City by Soleri reminds me of a structure growing like mushrooms and plants from the ground. What is interesting is how that architecture has more weight on the top than at the bottom. These megastructure compounds feature a residential and academic complex, administrative and public functions. The structures reach 1000meters. In virtual reality, you could fly around these structures and teleport yourself to different levels. From above you could enjoy the exciting qualities of these structures.

Arata Isozaki - Metabolism

"*Arata Isozaki, …his most interesting non-built projects: the futurist master plan, known as City in the Air, in the Shinjuku neighbourhood in Tokyo, Japan. At the end of the Second World War, in Japan - a country in full material and spiritual reconstruction - an avant-garde architectural and urbanistic movement emerged, known as Metabolism. The Japanese architects started to explore the relationship between the human being and the constructed environment. The Metabolism emphasized the concept of biological growth in architecture, implying that the city, as well as its structures, are living organisms that develop together. The architecture was now understood a being in constant transformation, a movement able to reflect in its design a dynamic reality. The Metabolists separated themselves from much of the established international discourse after the Second World War. They distanced themselves from the architecture defined by functional programming and moved towards one more focused on human association and mobility, reflecting on how to create utopic cities after the destruction of the war."* (María Francisca González 2019)

IMAGES FROM THE TOP LEFT: SIMULACRON 3 - BOOK, SNOW CRASH - BOOK, WORLD ON WIRE - SERIAL, BUTTERFLY COCOON, MATRIX - FILM, READY PLAYER ONE - FILM.

The relationship between the human being and the environment is in virtual reality can be interactive like in a computer game. The 3D space in VR is a mathematical construct created by the programmer and architect of Architectural and Artistic Space in Virtual Reality. In virtual space, we have a body of an avatar. We can understand VR Architecture as a constant transformation of movements that can reflect in its design a dynamic reality. I see there is a similarity between Isozaki's and my project. In virtual reality, spaces can grow according to the number of avatars visiting the VR space. Interactions, movements, changeable conditions are all that is possible in VR Architecture. It only depends on the design and functions of the VR Architecture how the space would behave. Opportunities are almost endless. It is the task of the VR architect to design the rules and VR spaces.

Reference to the Architectural Material:

Actuated Matter

Actuated mater is exploring the application of smart materials in architecture.

"The Actuated Matter Workshop explored the application of smart materials in architecture concerning their ability to transform architecture into an "Emotive Environment", a space that relates to its inhabitants in an emotive and responsive way. We focused on the capabilities and limitations of materials themselves in generating kinetic, visual and acoustic feedback. The goal was to endow artificial spaces with some of the qualities of a natural environment in which perceptual, behavioural, emotional and social processes are interrelated and arise from its intrinsic properties. The question arises on how we could incorporate aspects of organic systems within the new materials and new architectures?" Bächli K, Bieri U, Buzasi S, group of authors. (2011)

During this experiment, I was not even thinking about constructing my Flower in The City in physical space. What I was learning from Smart Structure was interactive behaviour. When parts of the material shine, change colour, movements. All these transformations are possible to program in NEOS VR when I design Architectural and Artistic Space for Virtual Reality. The emotive environment described above in virtual reality means an interactive environment. Space that relates to its avatars in an emotive and responsive way. In VR Architecture there can be visual, and acoustics features of the space. In Neos VR programmers and architects can use LOGIX programming to create these aspects of the space. It may look easier to build a structure in physical space with acoustic and complex visual features, but in Neos VR in LOGIX the programming is very demanding.

Reference to Experimental Architecture:

iheartblob

" VR room for rent. Society has emerged and mutated with the rise of the digital. We disregard common realities in favour of the screen. We can't get our phones out of our faces. It is at the point when it's

IMAGES FROM THE TOP LEFT: PAOLO SOLERI - MESA CITY, ACTUATED MATTER, VR ROOM FOR RENT - IHEARTBLOB, ARATA ISOZAKI - THE CITY IN THE AIR.

becoming an essential organ in our bodies. We play, we study, we work in VR. We design rooms in VR and soon real estate will rent it out for people to live, work and play in them. Architecture in the digital becomes important after all and we are to accommodate the new needs of a mutating society." (iheartblob, 2018) .

I think that we are mutated society, mutated by our digital life in social networks online and for some of us by social VR platforms identities. We are now as architect facing an unexpected change in designing architecture. In my opinion, there will be a new type of architecture in the future. We will design the Metaverse. That is why I created my topic: Architectural and Artistic Space for Virtual Reality.

Ryota Matsumoto

Ryota writes in his Speculative Morphology of Recurring Terrains /

"*…Recent work revolves around common themes that are built on the mythology of future cities, with emphasis on the socio-cultural aspects of innovation, resources and planning processes. The wide range of compositional techniques embrace varying scales and juxtapose amorphous and structural forms. They intertwine textures/patterns, oblique projections and visual metamorphoses and are employed to envision the potential scenarios of post-smart cities of the transhuman age.*

…Consequently, the myriad emerging biotechnologies blur and undermine the fundamental distinction between the natural and the artificial in the visionary cityscape of speculative urbanism. "(Ryota Matsumoto 2015)

Speculative urbanism and visionary cityscape can exist in virtual reality. There is a space for extraordinary ideas, unrealistic cityscapes. VR is the platform where many dreams of architects can become real. In my case study, I was testing 3D spaces in tall heights. I wanted to develop also plant shapes in many different colours. We can rarely experience this feeling in constructed architecture. The contrast between the known city structure and unexpected flower-like structure would create a moment of surprise in virtual reality. In this case study, I learnt that I would need to figure out something more than just a contrast. I realized that I want to interpret something existing, built architecture and art. The interpretation and new vision are the most important for creating VR architecture.

Kyle Branchesi

"*SCALEFULNESS is an attempt to undermine the conditions laid out by those who gave the twentieth-century city its shape. SCALEFULNESS produces an architecture at a scale beyond their scope. To place architecture back in the city, one must avoid the ground altogether. It must develop away, above and around the city, but never in the city. SCALEFULNESS plays with colossal differences: of scales, of morphologies, of effects, of legibilities and indices within its territory…*

SCALEFULNESS is represented within five panes, in a forced perspective that gives depth while never showing the full depth, size or limitations of itself. The colour used within the drawings removes the reality of the city above and forces its juxtaposition with the redundant, grey city below" (Branchesi K. 2015).

Manifests in architecture are needed, just like to from Kyle Branchesi The Scalefulness. During designing of my case studies, I was step by step getting closer to write a manifest how to design Architectural and Artistic Space for Virtual Reality. in each evaluating case study, I learned from mistakes and set up a new goal. The Scalefulness project is about the city and architecture on a scale

IMAGES FROM THE TOP LEFT: RYOTA MATSUMOTO - THE INDISTINCT NOTION OF AN OBJECT TRAJECTORY, KYLE BRANCHESI THE SCALEFULNESS, SNAP TAKEN DURING HIGH FIDELITY LOAD TEST, BLAST THEORY - CAN YOU SEE ME NOW - GAME.

beyond the scope. About the architecture that tries to avoid the ground level. That architecture is developed above and around the city, but never in the city.
"*Drawing has always been a tool to speculate on the future. It forms a surface for enacting the desires of society and proposing new ways in which architecture can facilitate them. From the seminal speculations of Archigram to Paul Rudolph's hulking megastructures in pen and Hugh Ferriss' crystalline 'Metropolis of Tomorrow', the twentieth century took drawing towards a multitude of possible futures. Most of these futures will never come to pass, but the potent power of speculative drawing continues. If science fiction is always using the future to say something about the present, then speculative and fantastical drawings speak of our contemporary concerns.* "(Laura A. 2016)
My contemporary concerns are about cities, architectural and artistic spaces for virtual reality. Places that we never build, and we could inhabit in the body of an avatar in the metaverse. Fantasies and utopias can come true in the metaverse. 3D internet is the future for all of us. Now we use 2D websites, but there are many new social VR platforms online that we can use. 2D internet is winning. But for how long? The Facebook company recently announced that Facebook is building the META, metaverse for VR and AR. There will be many metaverse companies. Some of them already exist, forex. Neos VR. It is just the beginning of future development in 5 or 10 years. Soon VR headsets will be affordable and computers faster to render virtual reality. The question is how we will build VR architecture for the metaverse. I am offing some new ways how to start to build a metaverse. Of course, I am showing my direction in designing the metaverse. I guess there will be many new directions in VR architecture. It is just like on the 2D internet, there are websites with artistic designed content, but there are websites with poor graphic design.

References to Art:

Syd Mead

„Science fiction is nothing but reality ahead of schedule." Syd Mead.
"If you want to know what the world could look like that best fits your science-fictional future, your best chance would be Syd Mead, be it dystopian cities and light cycles or organic spaceships and space habitats. Everyone from James Cameron to Ridley Scott and Neill Blomkamp agrees. No wonder then, that Mead is most often referred to as 'the artist who illustrates the future". Shenoy G. (2017) .
I wrote previously about the connection of science fiction and designing the Metaverse, designing Architectural and Artistic space for Virtual Reality. In case that in the future most of the people will use virtual reality spaces for communication, for education, business, shopping, relaxation online, then we will possibly live futuristic lives that could resemble the Syd Mead pictures.

References to Cyber Art:

2003 Can You See Me Now

"Blast Theory is a group of artists who works with mixed reality in the real city and its structure. In this game, there are „runners in the real city who use their mobile devices with satellite tracking capability to follow up to 100 players at the PCs in their corresponding virtual domain. The boundary between the urban space and the virtual worlds blurs. Thought the users don't see each other, they occupy the same space." (Ars Electronica 2003)

I see some similarities with my project. It is a game that is related to the existing city. Navigation in real cities with the help of virtual maps like Google Maps is very common these days. But it was not like that in 2003. In a way today, we use our smartphones and internet to navigate in Google Maps and computer calculate our journey through the city. In VR there is no need for navigation because you can fly above the city and see from above from distance where you are and where you need to be.

Design:

Design Process: My first step was: I derived the second case study from the first case study MAGIC FLOWER. I was testing a much larger scale. I wanted to design a large 3D object that would look like a massive cocoon flower. Avatars in virtual reality can fly around the cocoons in the sky. Avatars have with the view to the computer-generated city with skyscrapers that sprawl on the ground. The stems and cocoons that are butterfly nymphs inspired me. The 3D cocoons show colourful environment with vibrant textures. Avatars in a bigger group can inhabit this space.
During the design process, I created in collaboration with Jindřich Ráftl, his animation team and the consultant for VR Marek Kulkovský, the video:
GREEN TRAVELING IN VR https://www.youtube.com/watch?v=gOjIfhwnvbE
In this short film, we described an idea of green travelling in VR. The main idea is people will be using virtual reality to visit cities in the future in the body of an avatar. People will travel less in real life. It will lower emissions caused by fuels during actual transportation.
Another step was to imagine such a structure in a real city. I choose Barcelona. I did several collages in 2D with Barcelona background, because I love Antoni Gaudi's architecture. I had ideas that cocoon structures could grow from green areas of the city concerning existing green parks and trees. I tested sources from real sites as a source of inspiration for the virtual environment, for example in case study Barcelona. I used Gaudí's architecture like Casa Batlló, Park Güell. My structures were in 3D, but results were only 2D collages, images. I wanted to travel to Barcelona and try to research the essence of Barcelona. I designed my interpretation of Gaudí's architecture. I discovered a new type of architectural and artistic space for virtual reality. That idea I developed in my third case study.

Structure and Colors: I did several cases of Flower in the City. The first was the structure in the computer-generated city, where we used green stems and white cocoons, black and white city. The 3D model was a computer-generated city in Blender created in collaboration with Jindřich Ráftl. CTU supported our project by the SGS grant. We explored the view from the cocoons from the top. We created an animation of moving cocoons. My next idea was to design a collage of the cocoons with the existing city, Barcelona.
I used the same 3D model but different colours, red, pink, white. I manipulated those collages in 2D. I was testing night pictures and day pictures with different light. In the last case, I was importing my 3D model from Blender to NEOS VR.
In NEOS VR I had to reposition the model, rotate it, put new textures again to 3D cocoons. My 2D textures are artworks that I used from my previous projects. Each digital collage has its own story that is inspired by my life and dreams.

Composition: I designed one magic flower that grows from almost one spot. Cocoons are floating in space. The idea of this motion presents the video created in collaboration with Jindřich Ráftl, his

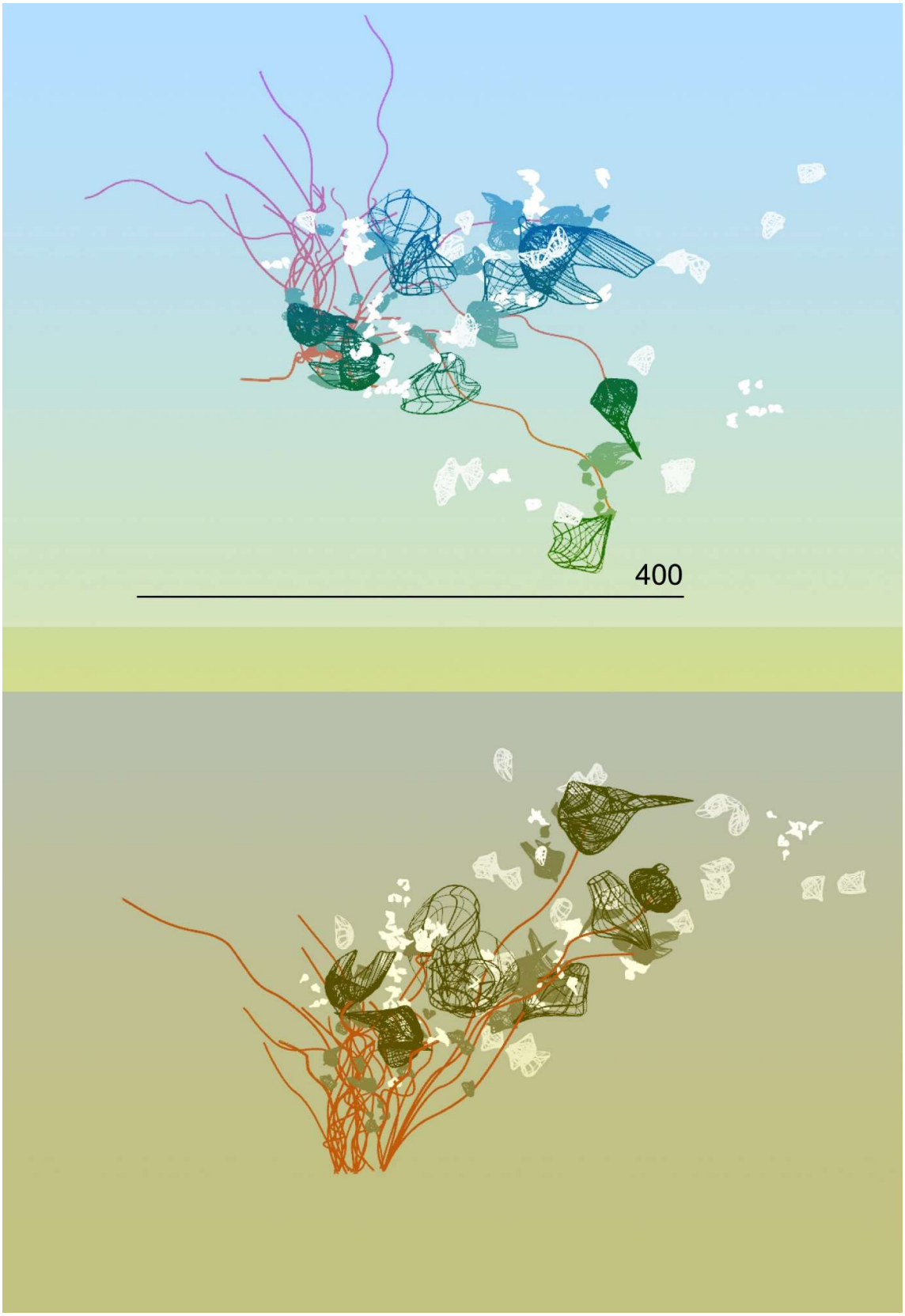
animation team and consultant for VR Marek Kulkovský, a video: GREEN TRAVELING IN VR. Size: I wanted the size of the cocoon flower to fit into the virtual city. It is the size of the wind turbine.

Evaluation: I wanted to design huge spaces: capsules, cocoons. Avatars would inhabit these cocoons in virtual reality. The size of them is a scale of a skyscraper city. I imported the new 3D model to the Neos VR. I tested the depth of the space if you are in the sky in the cocoon and you have a view of the city below you. In ordinary life, we don't have a chance to spend time in such heights as 360 meters. Another challenge was to explore different textures on cocoons with colourful images and patterns. We don't experience such organic spaces full of colours.
This case study concludes that I should interpret and reinvent a new type of environment: VR architecture, Architectural and Artistic Spaces for Virtual Reality. In virtual reality, we can reinvent the spaces for avatars. There is gravity in VR according to what we set up. There are no bearing structures needed. Objects can float in space and move. There is no need to copy existing architectural spaces because we can design a new environment, especially in virtual reality.

In Mel Slater's lecture, I want to highlight the idea that we don't need to simulate reality in VR. We need a new paradigm.

"A new VR paradigm must emerge from practice and CREATIVITY." Mel Slater 2017.

When I design, I do not plan to build 3D model of something that I designed as a sketch before. I design with computer, and I can never guess what the result of my design efforts will be. I just do my research by design. I compare results and evaluate 3D models in the metaverse.



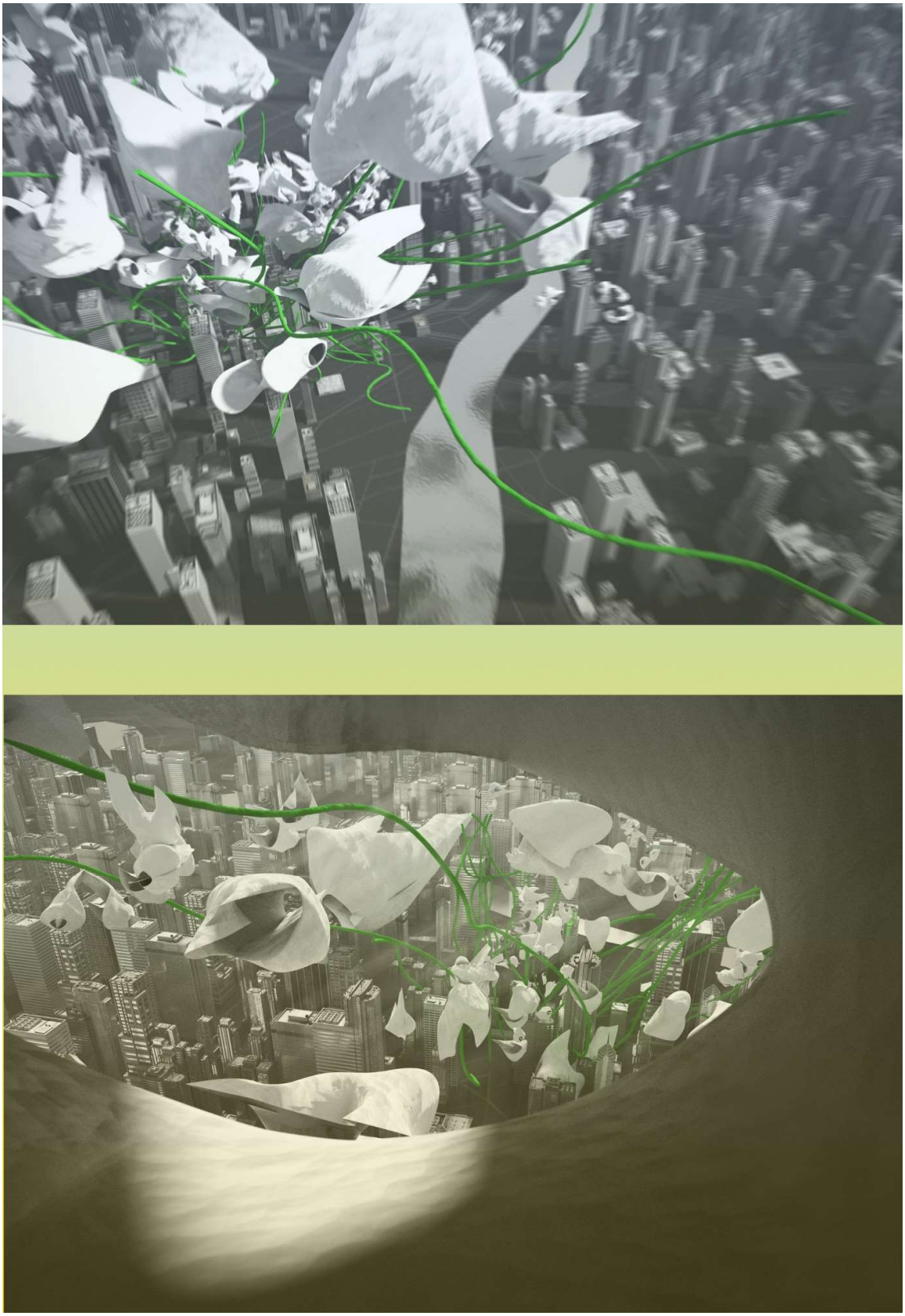
IMAGES FROM THE TOP: MARKÉTA GERBIAN - COCOON FLOWER - TOP VIEW OF THE 3D OBJECT - DIMENSIONS IN METERS - 2017, MARKÉTA GEBRIAN - MAGIC FLOWER - RIGHT VIEW OF THE 3D OBJECT - DIMENSIONS IN METERS - 2017.

Summary:

By designing a Metaverse, Architectural and Artistic Spaces for virtual reality, I don't try to simulate reality. I am learning from it because I want to invent some new types of spaces for virtual reality, VR architecture.

I am searching for new evidence of architectural and artistic activities in the metaverse. In December 2021, I saw a video created by Zaha Hadid architects.
Patrik Schumacher wrote about this project Cyber Urban Incubator:" This *video shows glimpses of the Liberland Metaverse. This is a work in progress. The Liberland Metaverse - a collaboration between Liberland, Zaha Hadid Architects, Mytaverse and ArchAgenda a.o. - is designed as a virtual industry synergy and networking hub for Crypto projects, crypto companies and crypto events."*
This video shows VR architecture for crypto events. What is interesting for me is that it still looks like they can construct it in the physical world. There are buildings, trees, people are walking on the ground. It is an approach, but the potential in VR is much greater than that. Zaha Hadid Architects are known for their signature organic shape and futuristic architectural spaces, but in VR, we can do so much more.
Zaha Hadid Architects working with Mytaverse, on their website https://www.mytaverse.com/ I have seen their projects: VR conferences, VR meetings, VR fairs. But still, all the spaces in VR look like spaces in the physical world. I agree that people need to get used to the virtual reality world first to feel comfortable there, and then maybe VR architects can show them more unimaginable spaces with full potential and possibilities of virtual reality. But what is the power of VR? I am trying to figure this out with my projects in virtual reality.

My point of view is that the architecture and art disciplines in virtual reality are disrupting.



BOTH IMAGES: MARKÉTA GERBIAN - COCOON FLOWER IN THE COMPUTER-GENERATED CITY - PERSPECTIVES. IMAGES CREATED IN BLENDER, COLABORATION JINDŘICH RÁFTL. AND HIS ANIMATION TEAM.

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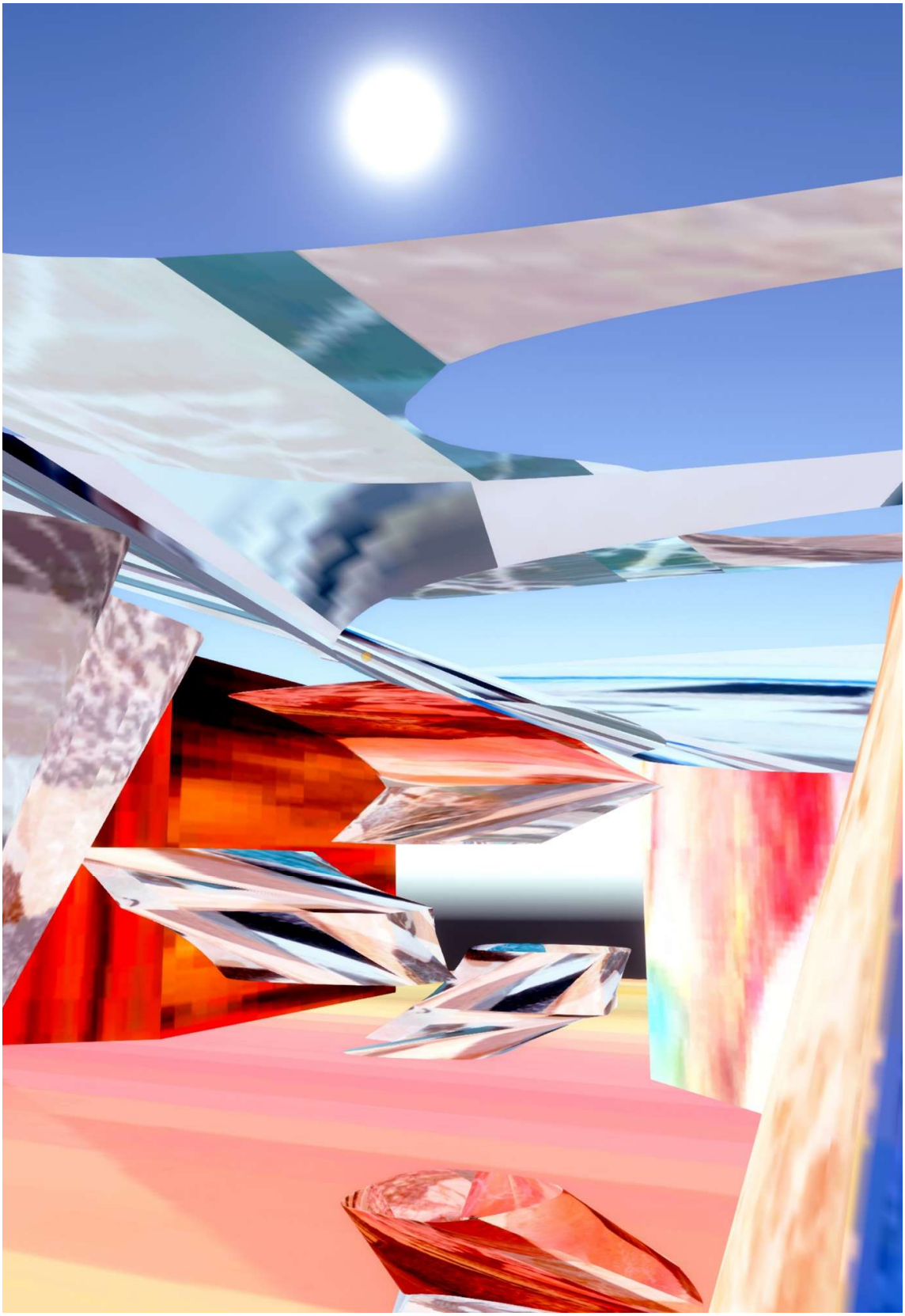


IMAGE BY MARKÉTA GEBRIAN FROM INSIDE OF VR CASA MILA LOOKING AT THE SUN, PRINTSCREEN FROM NEOS VR SOCIAL VR PLATFORM.

CASE STUDY III.

Title: INTERPRETATION OF CASA MILÀ IN BARCELONA INTO ARTISTIC AND ARCHITECTURAL SPACE FOR VIRTUAL REALITY.

Type of results: digital 3D model textured in Rhinoceros, renderings, digital collages, 3D model textured in NEOS VR. Static functional virtual reality world with the possibility to fly around the model and through the 3D model. NEOS VR is a creative social VR platform, that anyone can create an account and visit online in the body of avatar virtual reality worlds and create their virtual worlds.

Topic: I was testing static complex 3D structures in VR. I was inspired the by Antoni Gaudí's Casa Milà on the site was Passeig de Gracia in Barcelona. This case study is about shapes and colours in different spaces that we experience in human life rarely get the chance to experience. We cannot inhabit spaces, that are floating in the air without floor or ceiling or places, that are coloured and shaped organically. Now it is possible all that in virtual reality.

Dimensions: The whole 3D model has a rectangular base about 786m to 514m large. The 3D model of the interpretation of Casa Milà has 59m width, 95m length and 31m height. For exact size please see attached images.

Technique: I designed spaces as an interpretation of Casa Milà. I used floor plans as a reference for the shapes of my spaces. I deleted the spaces that are not useful in virtual reality: stairs, corridors, lifts, kitchens, toilets, bathrooms. I deleted the bearing structure, windows, doors, ceilings and somewhere also the floors. Spaces that remained were spaces where avatars meet, relax, work or even shop in NEOS VR. I built a 3D model from lines that I copied from Gaudí's plans, coloured in orange. I also used voids coloured in yellow on the picture. I used loft command in Rhinoceros to create spaces from different sections according to inspiration by famous chimneys on the rooftop. I used shapes of voids to design a double-layer floating roof. In 2019 I exported 3D model from Rhinoceros in FBX format into NEOS VR. I had to set up the position and rotation of the model in my new virtual world in NEOS VR. I had to upload new textures again in NEOS VR and place them on the 3D model in NEOS.

Year of creation: 3D model in Rhinoceros is from 2018. A functional static 3D model in the virtual world of NEOS VR is from 2019.

Task: To test complicated static spaces in a 3D model with exciting colours and organic shapes. In 2019 I used the NEOS VR program to create the virtual world with new textures in VR.

Location of the Project: Passeig de Gracia in Barcelona interpreted into a new neighbourhood in virtual

reality in NEOS VR. My 3D object has a similar size and height to Casa Milá. I extended the space to the whole block, so it is not just the building on the corner like Casa Milá. I was inspired for my architectural and artistic space for virtual reality by the historical urban plan Ildefons Cerdà. In the original plan from around 1860, Cerdà proposed open blocks of houses with inner gardens. Almost all houses are closed blocks and only in some of them are now trees or gardens.

Reference in history of VR:

1787 The Panorama

The English painter Robert Barker had this idea of 360 paintings, for example, created the city of London, a cylindrical space containing a 360 panoramic image end-to-end the prints stretched 3.25 meters. His goal was to produce "*the perfect Illusion of a real scene*." In my case study, I interpret a part of the city. I create mathematical constructs and illusions of the virtual space.

Reference to the Books:

1984 Neuromancer

It is a novel by William Gibson. The main protagonist, Henri Dorsett Case lives in future. There is a brain-computer interface that moves people through „MATRIX" a global virtual network. For Case, virtual reality is a 3-dimensional network of data nodes.

"People have been on the internet for years, and what takes place seems more fantasy than reality at times, especially the virtual reality, which is something people have strived for, but still is unsatisfactory in practical application. I say yes; not due to the description of future technology, which science fiction authors will never get completely correct (though Gibson is a better futurist than most writers), but because of the engaging plot and the intriguing characters. The host of characters includes regular humans, modified humans, clones, computer constructs of people, and AI (artificial technology) ". Christopher Fried. This is like NEOS VR, a social VR network.

Inspirations by fantasy worlds in films:

1995 Strange Days

A film about experiencing other people's lives through a special headset and minidisc produces a drug-like effect. In NEOS, we use a headset that can take you to virtual worlds. The experience in VR can be a drug-like effect too.

1999 eXistenZ

It is a film where people are in the virtual world with "Bioport"on their back. The inventor of NEOS VR "Frooxius" immerse himself in virtual worlds that he communicates with others almost only in VR.

2011 Black Mirror

TV Series shows some possible future scenarios with AR and VR. For example, with eye implants. We don't have eye implants yet, but we have Hololens and google glasses like devices from Black Mirror.

IMAGES FROM THE TOP: BLACK MIRROR - SERIAL, EXIESTENZ, STRANGE DAYS, NEUROMANCER, PANORAMA.

References to Architecture:

Antoni Gaudí Casa Milà

"For Gaudi, La Pedrera represented the most advanced approach to a building on a chamfered street corner in the Eixample in Barcelona. It consists of two blocks of apartments, each with its entrance, structured around two large, interconnected courtyards with ramps down to the garage for vehicles. The façade of La Pedrera is not a structural element: rather than serving the traditional function of a load-bearing wall, it is instead a curtain wall. The blocks of stone (numbering more than 6,000) are connected to the structure by metal components, thereby making the large windows in the frontage possible. The distribution of a typical floor is notable for its irregular geometry and its well-defined internal organisation, intended to make the most of the south-facing main façade. "
For me, the most important thing was to get inspired by the irregular geometry of the floor plans and the shape of the voids. I love the organic shapes of chimneys too.

Zaha Hadid Architects Serpentine Sackler Gallery 2009-2013

"The Serpentine Sackler Gallery consists of two distinct parts, namely the conversion of a classical 19th-century brick structure - The Magazine – and a 21st-century tensile structure. The Serpentine Sackler Gallery is thus - after MAXXI in Rome - the second art space where Zaha Hadid Architects have created a synthesis of old and new." Text description provided by the Zaha Hadid architects. Zaha Hadid Architects created new gallery spaces. She added a curving café, an events space that extends from one side. This building that I visited in person was spectacular because it gives the feeling to the visitor that the roof is floating in the air. The building looks like it is ready to fly, I love that aspect of this building. I wanted to use it in my project too. Make parts of the building flying, floating in space. In VR Casa Mila I created floating spaces, organic walls sometimes without ceilings and floors. I was just creating boundaries in VR space.

Yonna Friedman

"The theory of mobile architecture, conceived by Friedman in 1950s, called into question the Modernist vision whereby the inhabitants are required to adapt to a building and not the reverse: through sketches, models and animations the exhibition (in MAXXI in Rome) recounts the development of this theory while at the same time exploring the theme of improvisation as a "possibility" in the world of architecture, as theorised by Friedman from the 1970s." Gong Yan and Elena Motisi.

Yona Friedman represents an architect and artist at the same time. He works freely, Yona creates collages, visions and models with the ambition to be mobile architecture. This idea reacts to the catastrophes of the Second World War. This inspiration is exciting because Yonna Friedman wants inhabitants to adapt to the building. My strategy in the VR world is the same. I want avatars to adapt too to the new type of VR environment. Avatars should explore new spaces and inhabit them in a new way. The question is also how we will get used to the new body of an avatar. In VR, we use hands and heads to navigate in VR space. I have seen a video from Mytaverse where avatars in the conference had the same bodies of robots. Robots had their heads with faces as screens and videos of their real heads talking. It is a solution to how Mytaverse made a person feel immersed in the virtual world. In Neos VR or META from Facebook, avatars are fully 3D models. I prefer this version of avatars too.

Reference to Urban Plan:

Ildefons Cerdà – Eixample

"Spanish / Catalan engineer Ildefons Cerdà (1815-1876) won the competition with his Plan Cerdá in 1859 with a grid design of blocks and straight lines. Cerda's love of straight lines shows in his design of a 1300-hectare grid pattern of blocks of residential buildings with chamfered corners - blocks are called illes in Catalan and manzanas in Spanish. The Eixample (means extension) blocks in the Plan Cerdá measure 113 x 113 m and covered 14% of the total municipal area." Barcelonayellow.com. The original Eixample had in plan rich gardens with blocks opened, not closed. I used that feature in my interpretation of the virtual plan. Empty spaces and voids are my topic in VR Casa Mila too. I wanted to erase spaces of VR Casa Mila that avatars don't need: corridors, stairs, lifts, shafts, bathrooms, kitchens. My result is that there are floating walls and floors in space with floating roof.

Reference to the Architectural Material:

Chromatic Skins

Chromatic Skin is a research project about the architectural application of Color Changing Materials, namely Photochromic Pigments, inspired by Cuttlefish and its incredible ability to change colour and pattern at an unbeatable rate under different conditions. This project was created at the Institute for Advanced Architecture of Catalonia by the team: Stephanie Bashir, Carlos Bausa Martinez, Hristo Kovachev in 2014.

This concept of a colourful façade reminds my possibilities in the virtual reality worlds. I was thinking about my virtual architecture that will change colour during the daytime and in different seasons. I wanted to simulate some feeling of warm water, sun, night-time, or wintertime. I showed that concept only in digital collages and renderings but not in virtual reality yet.

Reference to Experimental Architecture:

M. Casey Rehm - Augmented Space 2011

"I have begun developing interactive digital environments utilizing inputs from spatial sensors to extend the utility and experience of designed space beyond the material. The video below is an example of a "dummy" environment used to explore methods for optimizing relationships between high populations of interactive geometry with large data inputs. In this case, a sample set of inputs is loaded every frame, reduced using voxel logics to manageable quantities, and then used as charge points for a magnetic field system. the example below utilizes spiral driven wires to enwrap the occupant and simulates moving inputs. "M. Casey Rehm.

I admire the work of Casey Rehm and his ability to transform his concepts into interactive digital environments. In my next case study Lisbon, I designed an interactive environment in NEOS VR. In the final case study Avatars in The Shell, I worked with Blender. I used the morph feature for my 3D model.

I imported it to Neos VR model, it worked. I was able to add motions to the virtual space, even though the goal was to create the shell of VR architecture that would be interactive, and it would react to the number of avatars using the VR architecture. In VR Casa Mila I wanted the space to be static but derived from local architecture and art.

References to Art:

Joan Miró – paintings

I love the way how Miró used combinations of colours. I love the abstract surreal objects floating in the space. I learned from shapes and colours as well when I was designing my virtual environment. I love the timeless space. We can only guess the inspiration for Miró's paintings, but we know it was something real like landscape.

Salvator Dalí - 1931 The Persistence of Memory

For me, this image represents the essence of a timeless VR world. The time that doesn't matter is when time is melting in the heat. Time in virtual reality exists when someone is wearing a VR headset, and the mathematical construct in the computer is on. When a VR headset is not on, the illusion disappears. It is like reality. Our reality exists when we live, our reality is a construct of our brain. Dalí was thinking about time, questioning the reality of our life.

References to Cyber Art:

Jeffery Shaw, Dirk Groeneveld - 1988 Legible City

Projects Manhattan (1989), Amsterdam (1990), Karlsruhe (1991) are 3D worlds like letters and words. Visitors can view these worlds by cycling on a fixed bike. This project is interesting because it shows a vision of an interpretation of different existing cities in computer graphic installation.

Michael Naimark - 1995 Be Now Here

Michael Naimark presents an installation where visitors with 3D glasses can visit cultural heritage sites like Jerusalem, Dubrovnik, Timbuktu, and Angkor, Cambodia. It is a similar idea to mine, but Naimark's project shows existing conditions, not the interpretations of these places.

1996 Bodies Incorporated

Was community of body ownership, to join the prospective member had to create the body out of prescribed textures, body parts and sounds. It sounds pretty much like designing an avatar in virtual reality worlds.

Emilio Galiacho - 1997 Able Skin

"The Able Skin is a media structure designed by architect Emilio Galiacho to hide any emblematic building that is not allowed to have a natural death, that is kept alive artificially through restoration, citation and simulation. A virtual reality installation allows participants to tour the first Able Skin, which covers Palladios Villa Rotonda. The participant's motion controls the point of view in the projected environments on the wall and the floor. "It is a project that works with the building that existed in the past. It is also an interpretation of the architecture of Villa Rotonda.

Design

Design Process: I tested complicated static spaces in a 3D model from Rhinoceros with exciting colours and organic shapes inspired by architect Antoni Gaudí and artists Joan Miró and Salvator Dalí. In 2019 I used the NEOS VR program to create a virtual world with new textures in VR.

Step one - I was inspired by the shapes of Casa Mila. I deleted spaces that are not needed in VR because, in VR, avatars move in a different way than people move. Avatars fly like an insect. We need to set some gravity must in VR. Basically, in VR, it is possible to teleport yourself from one place to another. That defines a different architecture, where ordinary spaces like corridors, lifts, stairs are not needed. In VR, you don't need to count on the bearing structure of the building. You don't need to fight with gravity. Spaces can float and don't need to have windows or doors, floors, or ceilings. In virtual reality, we don't use bathrooms, kitchens because avatars don't do such activities.
Step two - I marked spaces that remained in orange colour in the floorplan. I signed voids in yellow colour. I redrew outlines of those spaces in Rhinoceros I created closed splines.
Step three – From this point, I was working with those shapes like an artist, freely to design spaces inspired by chimneys on the rooftop of Casa Milà.
Step four – I designed the roof floating above all the spaces I used the shape of the roof plan of Gaudí.
Step five – I created surroundings of the interpretations of Casa Milà. I used an original plan of Ildefons Cerdà I designed opened blocks with gardens.
Step six – I experimented with the textures. I used only three textures for the whole project. I manipulated renders in 2 D to express different kinds of weather, night and day conditions too.

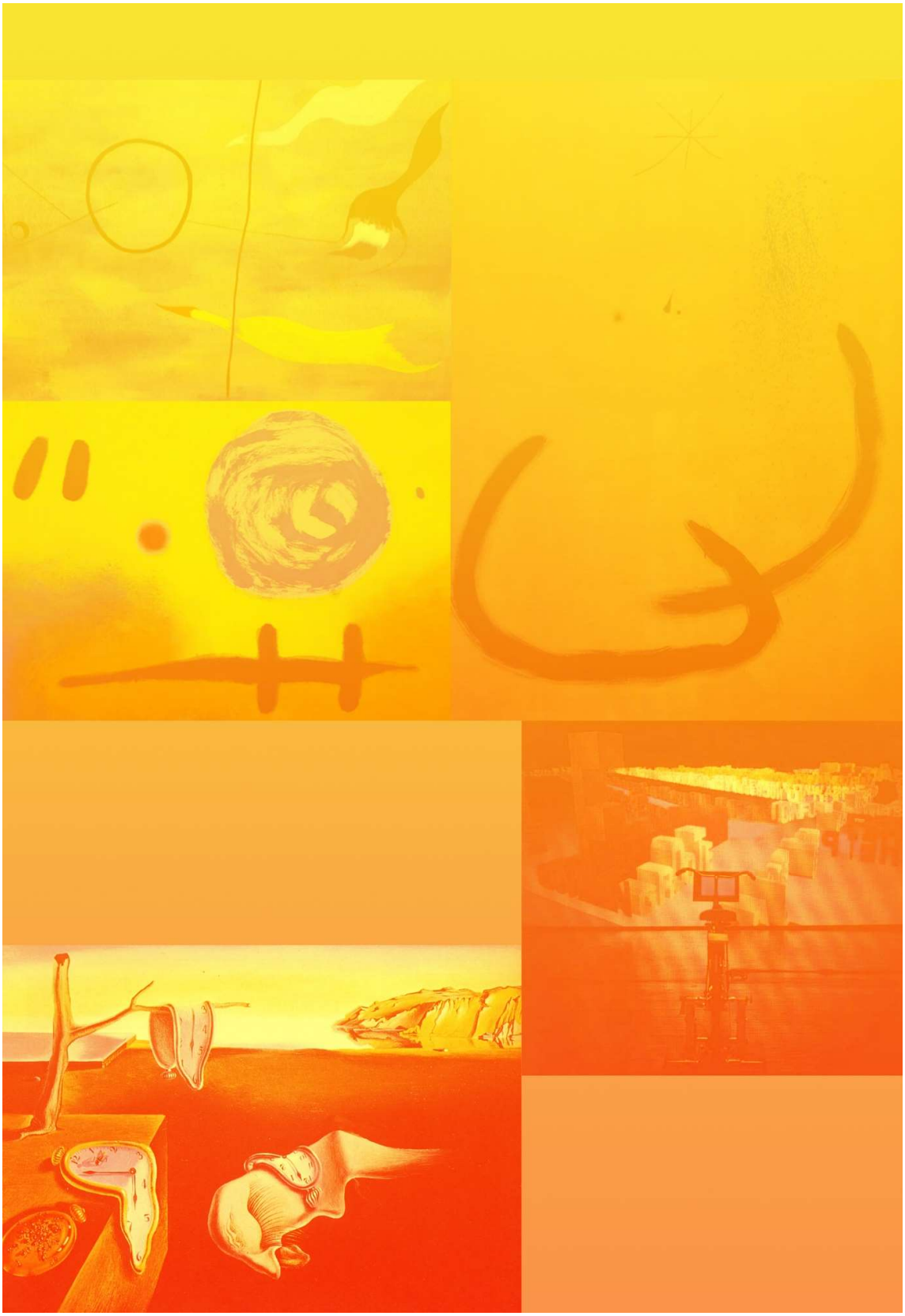
Structure and Colours: The structure of the model are floating levels, floating 2 layered roofs and "chimney spaces" under it. I used textures, photos from the existing site, facade of the Casa Milà. Photo of the ceiling in the restaurant and ceiling in the inner courtyard. Then I manipulated in 2D the colours of the renders to express different weather and light conditions.

Composition: I intuitively played with the compositions of the chimney spaces. My method was tested and tried I rendered about 40. Images in the process of designing interpretation of Casa Milà.For the surroundings, I used ideas from the Ildefons Cerdà master plan. I used sizes from Eixample blocks and the Ildefons Cerdà master plan, and I was inspired by the spaces of the rooms in Casa Milà when I designed VR architecture.

Evaluation: I wanted to design my interpretation of existing sites and architecture and use data from reality to transform them into architectural and artistic spaces for virtual reality. I wanted to work with NEOS VR and test the complicated shapes in a static environment. Also, the next challenge was to explore different textures on organic shapes in NEOS VR. In our life, we don't fly in spaces without floors and roofs, spaces without gravity. I tried to interpret and reinvent new types of VR architecture online: Architectural and Artistic Spaces for Virtual Reality. My floating structure can behave as an environment where avatars can meet, interact, work and in future in NEOS VR also shop.

Summary:

It is a small step in designing a Metaverse, I wanted to invent a new type of architectural virtual reality world. Now the IT professions are taking over the architectural design in VR. Sara Eloy wrote on social networks: *"Fed up with computer scientists doing architecture research without architects. The amount of bullshit in papers about what is architecture design is annoying and killing off what is a quality*



IMAGES FROM THE TOP LEFT: JOAN MIRO – PAINTINGS. LEGIBLE CITY 1988 - JEFFERY SHAW, DIRK GROENEVELD. SALVATOR DALÍ 1931 – THE PERSISTENCE OF MEMORY.

designed space. While most architects are still in an autistic way away from this development, computer scientists, alone, will take over and the consequences are unpredictable, starting by automatically designing buildings becoming badly designed. All this current talk is about multidisciplinary and, at the end of the day, no multidisciplinary. Too much speed in these times and few want to take time to think well."

I must agree with this strong opinion. Architects should start designing the Metaverse. The Metaverse is a new type of illusion of space where people will spend time soon.

How to design metaverse and 3D internet? There are many different approaches. The main one is copying the physical space, creating visualizations of 3D spaces easy to build in physical world. In my opinion, architects are the ones who bring concepts, ideas, and beauty to virtual spaces.Without ideas, we can barely build virtual worlds that would have content. What is the content that would be useful for future generations? We need to figure this out. It may take ten to fifteen years before the metaverse companies create virtual worlds with quality designs and environments. It is a similar situation with the 2D internet. It took a few years before a graphicly designed website emerged. In this case study Interpretation of Casa Milà in Barcelona into Artistic and Architectural Space for Virtual Reality, I showed how much value the inspiration from physical space, architecture, the city could be.

I researched a virtual space, new VR architecture. I worked with the Casa Milà building, with drawings, chimney structure and the roof terrace. My inspiration was the skill of Catalan artists, their colours schemes, the atmosphere on their paintings. I experienced the site personally, which gave me a new perspective to see the environment and new possibilities to interpret reality. If we can do anything in VR that is possible to construct in 3D programmes, why not use all our imagination to create new virtual worlds. Zaha Hadid Architects posted on Youtube a video where their office is designing part of the city called Liberland for the metaverse called Mytaverse in December 2021. It is great news that the world knows architects like Zaha Hadid are involved in designing the metaverse. I became a part of the community on Facebook that is interested in metaverse called The MetaVerse Research. There are posts about metaverses that are new to me. It is exciting to observe how people think of the metaverse. How they design it, how they are using the metaverse. Architects are usually not involved in the discussions, but designers of the metaverse are called 3D assets builders. In TCG World metaverse some videos show a landscape with mountains, rocks, trees, grass, villas, avatars are walking in the ground. It still creates copies of some physical environments. I know that opinions are saying that transition between the real and virtual environment should be slow and smooth. People don't want to be shocked by the unknown space in VR. Well, in my opinion, there can be both approaches. Mine is the unknown direction of designing spaces.

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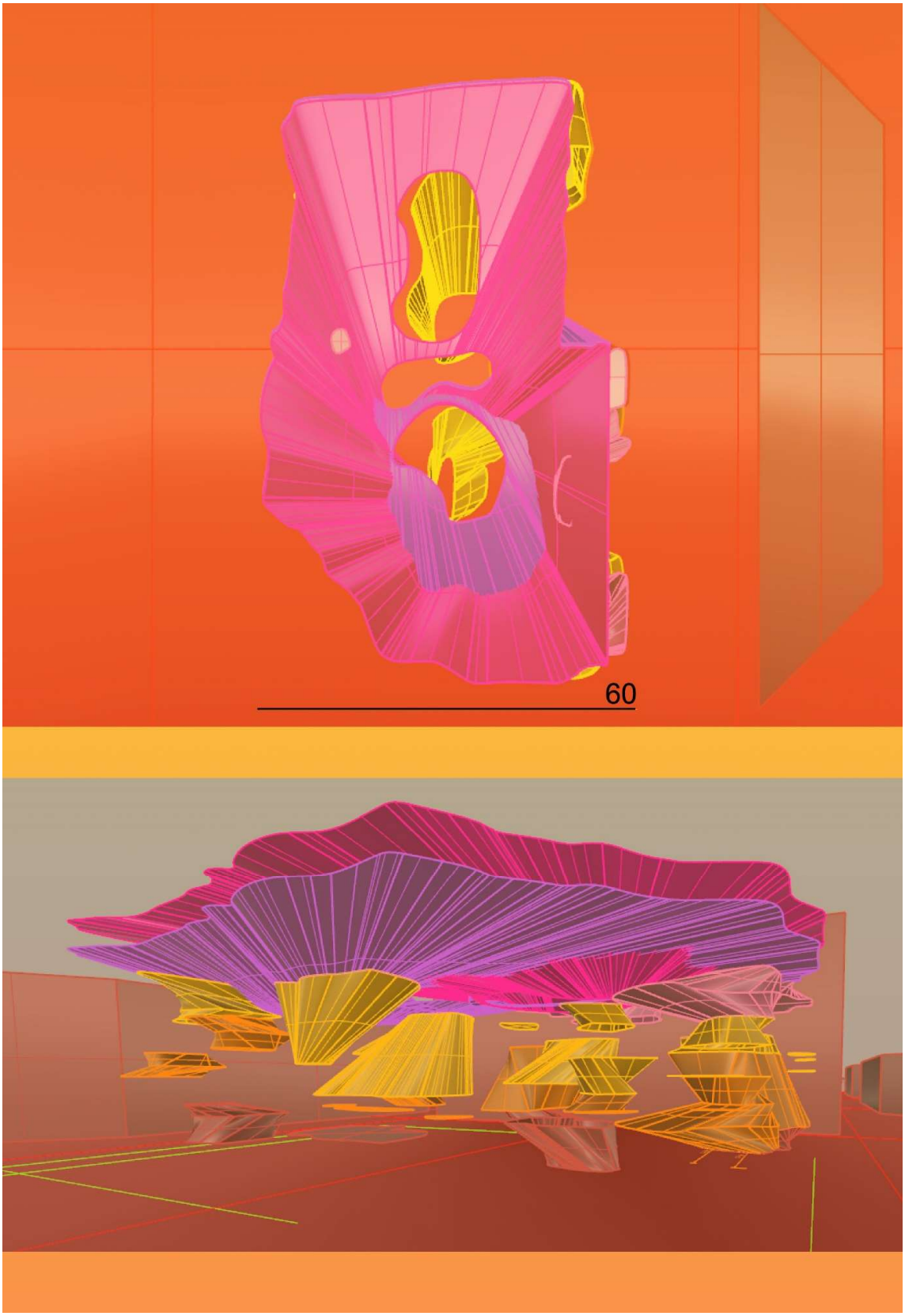
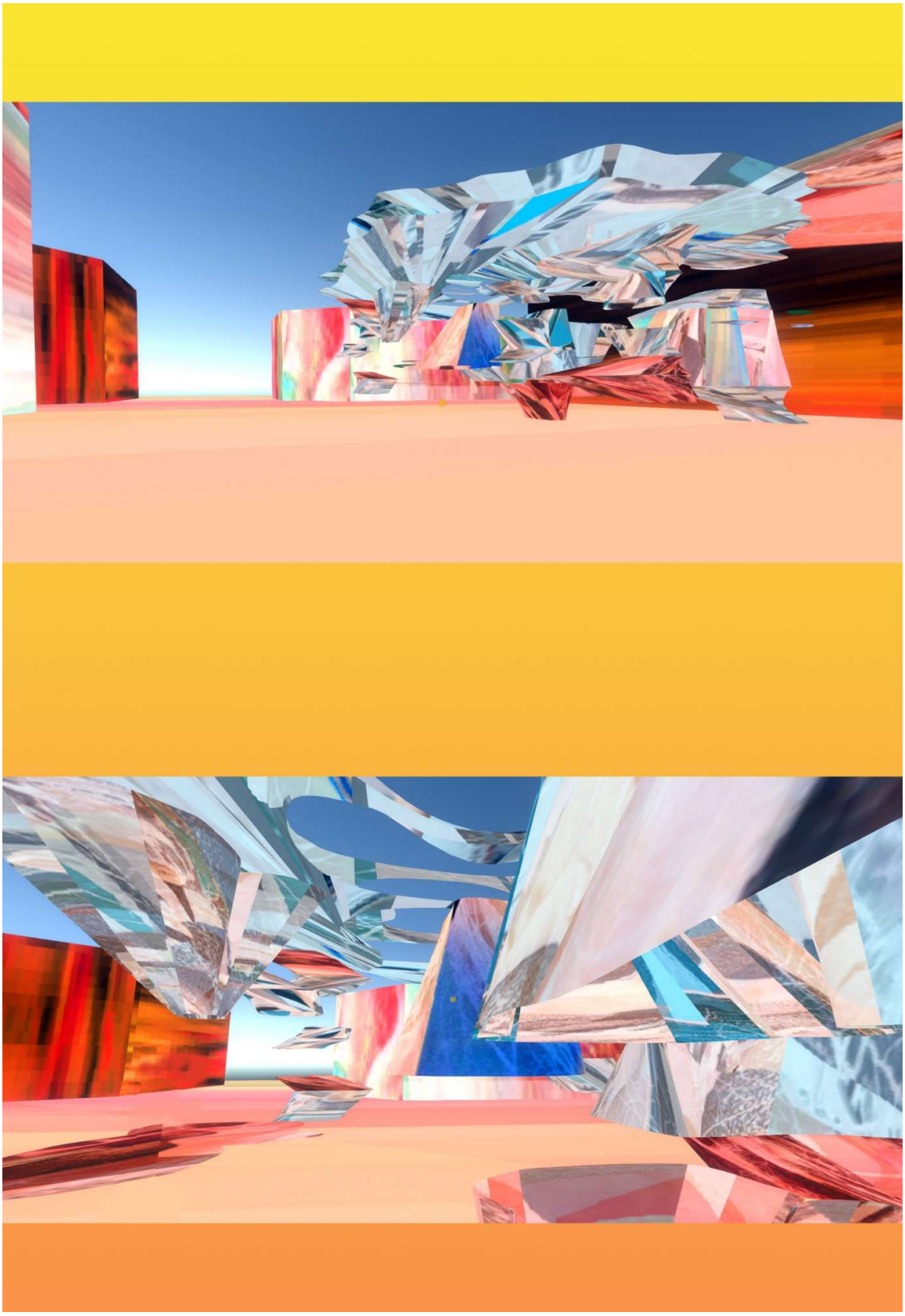
IMAGES FROM THE TOP LEFT: I. CERDA - EIXAMPLE PLAN, EIXAMPLE TODAY, A. GAUDI - CASA MILA COURTYARD AND CHIMMNEYS ON THE ROOF, FACADE OF CASA MILA.

IMAGES FROM THE TOP LEFT: ISNPIRATIONS BY CHIMMNEYS AND ROOF OF CASA MILA, RHINOCEROS 3D MODEL – MARKÉTA GEBRIAN, CEILINGS AND FAÇADE OF - CASA MILA. EIXAMLE INTERPRETATION - MARKÉTA GEBRIAN. USE OF PLANS BY ANTONI GAUDÍ, VOIDS AND SPACES FOR VR MODEL FROM CASA MILA INSPIRATION – M GEBRIAN.



IMAGES FROM THE TOP: MARKÉTA GEBRIAN - DRAWING: TOP VIEW, PERSPECTIVE VIEW.



IMAGES FROM THE TOP: MARKÉTA GEBRIAN – PERSPECTIVE FROM THE STREET LOOKING AT VR CASA MILA. PRINTSCREEN FROM NEOS VR SOCIAL VR PLATFORM, PERSPECTIVE FROM THE INTERIOR OF VR CASA MILA, PRINTSCREEN FROM NEOS VR SOCIAL VR PLATFORM.

IMAGES FROM THE TOP: MARKÉTA GEBRIAN – PERSPECTIVE FROM THE TOP LOOKING AT VR CASA MILA ROOF, RENDER FROM RHINOCEROS. PERSPECTIVE FROM THE INTERIOR OF VR CASA MILA, RENDER FROM RHINOCEROS.

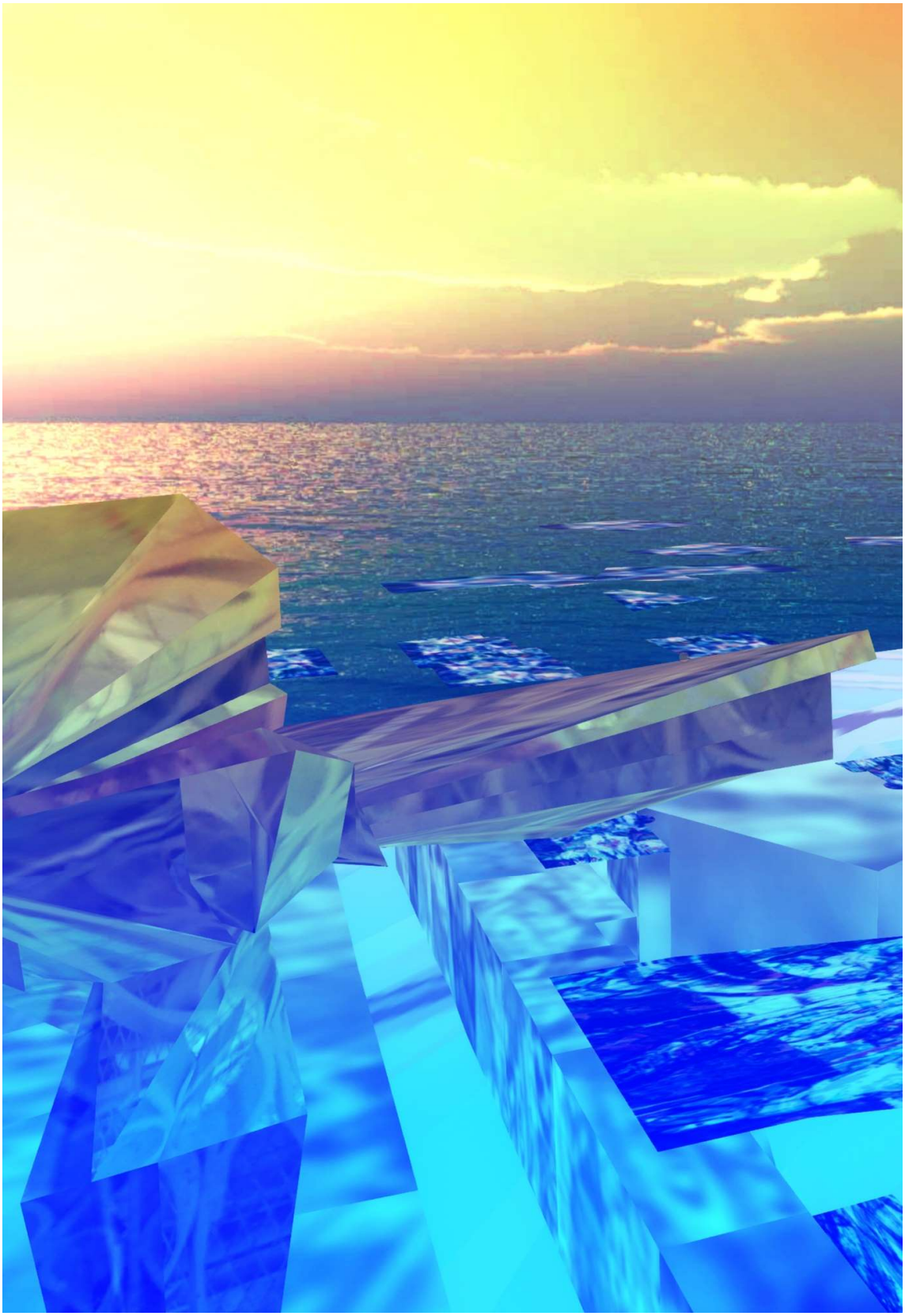


IMAGE BY MARKÉTA GEBRIAN - PERSPECTIVE VIEW, ELEVADOR SANTA JUSTA, PRINT SCREEN FROM NEOS VR METAVERSE, 2020.

CASE STUDY IV. Title: INTERPRETATION OF ELAVADOR SANTA DA JUSTA INTO ARTISTIC AND ARCHITECTURAL SPACE FOR VIRTUAL REALITY MEETINGS.

Type of results: digital 3D model textured in Rhinoceros, renderings, digital collages, 3D model textured in NEOS VR. Static functional virtual reality world with the possibility to fly around the model and through the 3D model.

Topic: I spend almost two months in Lisbon at the ISTAR-Information Sciences and Technologies and Architecture Research Centre (ISCTE-IUL). ISTAR had the equipment for virtual reality. I could test my projects in NEOS VR, with a VR headset. My visiting research was under the supervision of Professor Sara Eloy. I was searching for the essence of Lisbon. Of course, Lisbon is a city full of hills. There are old yellow trams and elevators helping people to move uphill and downhill in the city centre. Today most of the trams and elevators are tourist attractions. One of them is Elevador de Santa Justa. It is a lift transporting people from the Rossio area to Chafariz do Carmo near Praça Dom Pedro IV square in Lisbon. Elevador de Santa Justa is made of iron with filigree details built-in in 1902. The history of the surrounding area: In November 1755, there was an earthquake in Lisbon, there were fires everywhere in the city. After that, a tsunami came. This combination of catastrophes destroyed most of Lisbon. "*From this chaos emerged the Marquês de Pombal, with the approval of the King, immediately brought order and began to develop efforts to create the new Lisbon. The effort first focused upon the development of four options that included rebuilding the city as it was, reconstructing the city with minimal improvements to the street pattern, undertaking a total rebuilding effort or starting fresh on a new site." (*Mullin)
New Lisbon around the Baixa, planned as simple straight streets leading to Tagus/Tejo river and with the same rectangular city blocks. If you look at the map today, you can see what remained from the old city. The Tsunami did not damage the hilly areas of Lisbon. These areas still have very complex street structures. A typical example of that neighbourhood is Alfama. I was interested in the new urban plan from 1755 that surrounds Elevador de Santa Justa. It is a very innovative urban plan. This plan was built much earlier than the famous Eixample urban plan from Barcelona from 1860. I was inspired with my 3D structures by the existing architecture Elevador Santa de Justa and the site in Chiado-Rossio in Lisbon.
Actions from the physical world are moving to the virtual world online. In the future, there will be 3D virtual shared worlds in social VR platforms like NEOS VR, not only Neos but other Metaverse companies. I was researching the architectural VR elements elevator and floor in my case study Lisbon. I was focused on movements, flying and teleporting in space on different levels 'VR miradouros'. In my VR case study, the elevator Santa de Justa is transformed into a statue where we can teleport ourselves up or down with high speed. There is a visual programming LOGIX that we can use for complex actions in VR.

Dimensions: The whole 3D model has a rectangular base about 342m to 263m large. The 3D model of the interpretation of the Elevador Santa Justa has a 63m length, 14 m width and 80m height.

Technique: I designed spaces as interpretation Elevador Santa de Justa. I used elevations as a reference for the shapes of my VR elevator. I worked on the VR elevator like on a statue in VR. Spaces that I designed should work like this: when you as an avatar approach the elevator in VR,y NEOS VR teleports you fast to the upper level with VR miradouros. Getting up would be only possible by VR elevator and getting down to the buildings on the ground. I built a 3D model from lines that I copied from the map of the Chiado-Rossio. I designed a similar 3D environment like when I would create an architectural project. 3D statue of the elevator in VR is my artistic interpretation of Elevador Santa Justa. In 2019 I exported 3D model from Rhinoceros in FBX format into NEOS VR. I had to set up the position and rotation of the model in my new virtual world in NEOS VR. I had to upload new textures in NEOS VR and place them on the 3D model in NEOS.

Year of creation: the 3D model in Rhinoceros is from 2019, functional static the 3D model in the virtual world of NEOS VR is from 2019.

Task: To test complicated elements elevator and floor, also a new type of organization of avatars in VR space.

Location of the Project: I interpreted the existing site of the Chiado-Rossio area in Lisbon into a new neighbourhood in virtual reality in NEOS VR. My 3D elevator has a similar size and height to Elevador Santa Justa. I derived my architectural and artistic environment for virtual reality from the historical urban plan of Marques de Pombal after the earthquake in Lisbon in 1755. The surrounding area are simple blocks with flat roofs in my 3D model. I also interpreted the Convent of Our Lady of Mount Carmel, a former Catholic convent located in the civil parish of Santa Maria Maior.

Reference in history of VR:

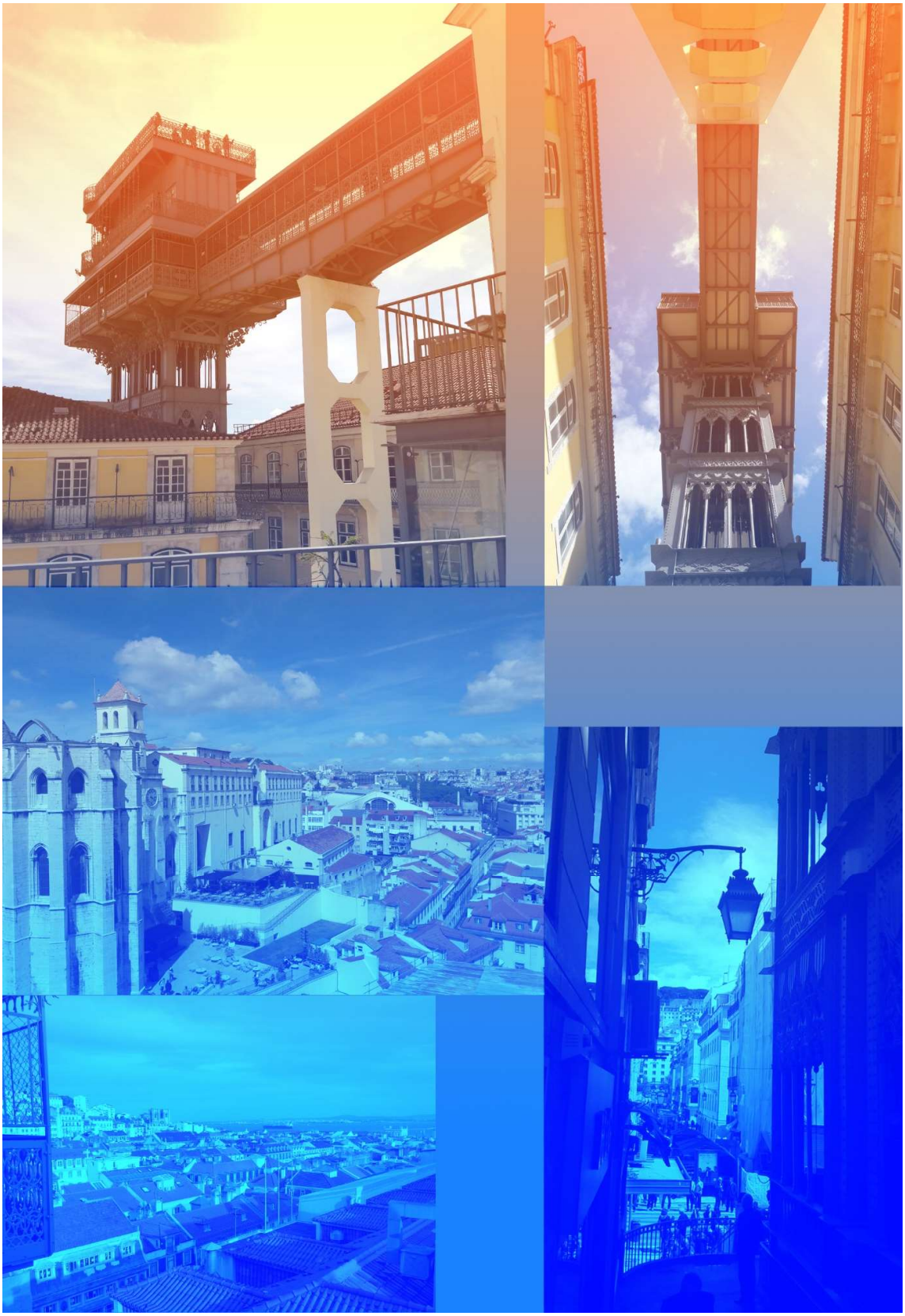
1995 Be Now Here - See more information in previous chapters.

2003 Can You See Me Now - See more information in previous chapters.
I based my VR world of case study IV. on the orientation of avatars in 3D space, the interpretation of Lisbon.

References to Architecture:

Raoul Mesnier du Ponsard - Elevador de Santa Justa 1902

"Built-in 1902 by Raoul Mesnier du Ponsard, a Portuguese engineer said to be a disciple of Gustave Eiffel, the giant Elevador de Santa Justa is Lisbon's only public vertical lift. Santa Justa together with the city's three funiculars (Bica, Glória and Lavra) help make Lisbon's hills a little more manageable. During the first years, the lift was steam-powered, being electrified in 1907. The tower was an important work at



PHOTOS BY MARKÉTA GEBRIAN FROM THE TOP LEFT: THE ELEVADOR SANTA DA JUSTA, VIEWS TO THE BAIXA CHIADO AREA FROM ELEVADOR SANTA DA JUSTA, STREET VIEWS TO THE ELEVADOR SANTA DA JUSTA IN LISBON.

the time since it connected the downtown Baixa to the upper Carmo Convent by a passageway. Today, Santa Justa Lift is a tourist attraction. A wooden cabin takes visitors 32 metres up inside an eccentric, yet familiar wrought-iron tower decorated with filigree work. At the very top of the tower, a eccentric, yet familiar wrought-iron tower decorated with filigree work. At the very top of the tower, a viewpoint reached by a spiral staircase offers great views over Lisbon. "(Lisbonguru)

The lift itself reminds me of the Eiffel tower in Paris, but this is much smaller in Lisbon. I loved the decorations and old interior of the elevator and filigree work in the monument. I used the idea of an elevator like the landmark. I created a 3D sculpture, that would be teleporting avatars into upper spaces with floating miradouros in VR. The concept of the elevator in Neos VR requires visual programming LOGIX. I had lectures on LOGIX programming at the Faculty of Information Technology. I could see and understand what it takes to program an elevator. However, it was too complex for me. So I created a scenario: when you approach the VR elevator from the ground, spaces marked around the VR elevator and inside the VR elevator takes you to the upper level. In this VR world, it would be different gravity. On the ground of the VR world, you would walk in the maze of buildings and then reach the VR elevator. VR elevator would take you to the upper viewpoint. From this point, it would be possible to jump, teleport yourself to another miradouros. The idea was that each miradouro would have two textures, one if it is empty and another when the avatar step on the miradouro.

Aurelio Galfetti – Castelgrande Bellinzona, Switzerland, 1981

The most important topic in my VR project was to get inspired by an elevator that gets you from one world to another like the lift in Bellinzona Castle from Galfetti. *"Preserve = Transform was the slogan held up through the long process of restoration that lasted more than twenty years. In the relationship between ancient and contemporary, in this unavoidable conflict, someone can face this straight comparison between past and present without subordinating the latter alleging the higher values of the past. In the past, for 6000 years, from the birth of the Neolithic village on the hill, this relationship has been repeatedly made without the difficulties which today meets, giving the whole building that particular beauty that comes from layering different ages. I did not want to stop this process during my task but give it a continuation in the contemporary world. However, after 25 years of works, what will be more enduring is that done quietly, disregarding major conflicts: the introduction of the territorial dimension and scale within the concept of restoration. The commission was only about the buildings on the top of the rock. I believed it was more important to give the restoration an urban dimension. The project develops some secondary spaces to support the city producing a park, a public park in the city of Bellinzona only made of rock, stone walls, four trees and a lake in the sky. A park is a place to go and stay, and so this proposal involves a route through a public space, a void that connects people with the great landscape down to Lake Maggiore, on the Alps."* Aurelio Galfetti

The interpretation of architect Aurelio Galfetti of the historical building and transformation it into contemporary architecture is an example of how to deal with ancient and the present. Using the information from existing and creating something new is related to my approach in designing Interpretation of the Elevador Santa da Justa.

In virtual reality, we don't start to design the VR architecture as a blank 3D space. The history and culture are making this empty virtual space full of content. |Because we expect something we already know. VR architecture is derived from the history of architecture and built structures. We are used to our experience from the physical world, yet I don't want to copy existing structures, architecture, cities. Architects of VR architecture can achieve much more by their interpretation. We can choose from any building or spot to interpret, architecture from the past or contemporary building. Unbuilt utopian projects can inspire us. There is such freedom in what to choose as our source of inspiration.

Reference to Urban Plan:

"In Lisbon in 1755, an earthquake of 8,75 degrees in the Richter scale took place, with its epicentre in the ocean, 200 km away from the southwest Portuguese coast (Baptista et al., 2006). The seism was accompanied by other calamities, a fire of great proportions that lasted several days and a tsunami that strokes the city 40 minutes after the quake...The most affected area of the city was the Baixa, the downtown placed in a valley that in prehistoric times used to be a gully… After the seism, the majority of the efforts and resources were directed to the reconstruction of the capital. During this time a major historic and political figure of Portugal rose, Sebastião José de Carvalho e Melo, mainly known as the Marquês de Pombal. This minister was in charge of the rebuilding process, organizing the competition and coordinating the allocation of the financing…
The different proposals included a regular grid of rectangular city blocks, including a certain standardization as well in architecture. This design principle created an urban tissue with completely different proportions when compared with the previous medieval urban structure still presents in the resilient section of the city, in the Alfama and Castelo hill. The hygiene concerns, an important issue of the time, forced a regular structure that granted better ventilation, sunlight and easier access. The winning proposal, developed by Manuel da Maia, Eugénio dos Santos and Carlos Mardel ". (Jose Manuel Pages Sanchez)

I used the existing plan from 1755 with rectangular blocks. I used that idea to design 3D objects, blocks where avatars can get lost until they find the VR elevator. Avatars cannot fly up from the ground. VR lift teleports them to VR miradouros.
I wanted to create a virtual world with a moment of surprise for avatars. There would be rules. Avatars would move differently on the ground in the maze of 3D buildings, but on the top, there would be the space of miradouros where avatars would fly. I copied the plan of Marquês de Pombal. I used the block structure of the VR architecture in Neos VR. I used textures of the azulejos, typical Lisbon tiles. On the whole ground level, there is this type of image texture. The 3D VR elevator has a texture, a photo of the elevator Santa Justa. Floating miradouros have also textures of Lisbon tiles. The background of the VR world is sea and sunset sky.

The earthquake in Lisbon in 1755 was very destructive. It changed the history of Lisbon so much, but there was one positive effect that this event had. It was the structure of rectangular city blocks, and it was the beginning of modern urban planning. It was healthier for the inhabitants of Lisbon. There was enough sunlight and ventilation. In my virtual world, we can see that this rectangular structure creates a maze with the same textures.

Reference to the Architectural Material:

Mistaken Identity - Mashal Wajid - 2018

Supervision - Prof. Dr Jasper Cepl, Prof. Dr Manuel Kretzer -Dessau International Architecture Graduate School. *"The city infrastructure is a mixture of analogue and virtual systems. Beaming, projecting, animating and generating information and media for everyone per their preferential desires, needs, proxemics and plans. Spaces vary in their technological integration. Some are completely immersed*

environments and others have varying degrees of transformability. A wholly integrated subject feels a part of the city. The body becomes the city and the city an extended body… The various sensors embedded in the structure of the building allow it to consciously allow the subject to move easily and make the surface texture and visibility match the user preferences." (Mashal Wajid)

Processes mentioned in the project of Mashal Wajid are like in my VR project. In NEOS, you can do LOGIX programming design for changes in 3D space. To change colours, textures or make some objects change the movements of avatars.

References to Art:

Helena Maria da Silva - paintings - interpretations of cities

I visited galleries in Lisbon, and I got inspired by the Portuguese artist, painter Maria Helena Vieira da Silva and her interpretations, paintings of the cities. My artistic agenda, my goal what I wanted to achieve with the Lisbon case study, was to show that virtual space can be derived from real sites and existing cities like Lisbon and existing paintings of Helena Maria da Silva. I saw on the paintings of da Silva (1908-1992) rectangular elements, something like a grid, but irregular, blurred, poetic but related to the existing structure of the city like Lisbon and Paris. I had an idea that some levels like these fields from Silva's paintings, can float in the virtual space in NEOS VR.

Design:

Design Process:

My design process tested how to organize movements in 3D space in VR. The idea was to design simple moving floors -miradouros in VR and static environment down in the ground. In 2019 I used the NEOS VR program. I designed a 3D virtual world with new textures in NEOS, but I did not finish the miradouros interactions. The LOGIX visual programming was for collaboration with the Neos VR specialist.

Step one - I was inspired by the shapes of the Elevador Santa da Justa. I used the idea of the elevator, getting people up and down. I wanted to move avatars fast to another environment to the floating moving levels. I used the existing Elevador Santa da Justa. It was an artistic approach. I designed a statue VR elevator.
Step two – I designed simple blocks based on a map of the existing site.
Step three – I simplified the Carmo Convent uphill.
Step four – I designed floating rectangular levels, floors. The Portuguese artist Helena Maria da Silva inspired me with her paintings.
Step five – I design the base, the ground.
Step six – I imported the 3D model from Rhinoceros to NEOS VR. I scaled it, rotated and imported different new types of textures. I used colours of Lisbon, pale brown, pink-violet and of course blue. I selected background sky with the sea, related to the view of the Tejo river in Lisbon.
Step seven – I was not using LOGIX programming, so the project is like a 3D VR concept.

Structure and Colors: The structure of the model are floating levels, floors and the elevator in VR with surrounding simple blocks and ground. I used textures, photos from the existing site. I used details from the facade of the Elevador Santa da Justa. I also took some pictures of the typical Lisbon tiles. I manipulated those photos in 2D, so they have different colours. The VR environment has the sea in the background. It is related to the view from the miradouro of the Elevador Santa da Justa with the Tejo river.

Composition: I intuitively worked with the idea of the miradouros -viewpoints of the hilly Lisbon. My method is research by design. I tested in 3D in Rhinoceros some possible options of locations near Elevador Santa da Justa. Elevator in VR was the main element of the composition. VR levels, miradouros were supposed to be flying slowly in space and change texture when the avatar approaches the VR level. For the surrounding areas, I used some ideas from the Pombal master plan from 1755.

Images with sizes of the structure in Rhinoceros: All sizes of my architectural and artistic spaces for virtual reality are comparable with the Pombal masterplan and the Lisbon city blocks in the area Baixa-Chiado. The VR elevator is a little bit bigger. My architecture for virtual reality uses the sizes of the Elevador Santa da Justa.

Evaluation:

During my visiting research, I worked with historical plans, maps and photos of Lisbon. My observation of the site was significant. My strategy was to interpret Lisbon, plus the area Baixa Chiado. I created my vision of VR Lisbon. I derived my 3D models from reality, but I did not copy Lisbon. In virtual space in virtual reality, we are in a different situation than in physical space. The body of our avatar in VR can fly, can teleport to places we need. The essence of moving through the Lisbon centre is walking up and down or using elevadors and trams. My interpretation of the elevator Santa de Justa is a virtual statue. This statue is like an arrow that points to the floating levels that represent viewpoints – miradouros. The miradouros are in Lisbon to offer views of the city. This fact returns to my NEOS VR world. If an avatar approaches the floating level with blue tiles, the texture changes and shows some other tiles typical for Lisbon. I wanted to achieve immersive 3D virtual space in NEOS VR. I questioned the boundary between digital art and architectural space for virtual reality.

Summary:

Again, it is a small step in designing a Metaverse, but I wanted to invent a new architectural virtual reality world. Architects should design the Metaverse and collaborate on VR projects together. I attended a NEOS VR course at the Faculty of Information Technology for one year. I learnt how to import 3D models in NEOS VR, manipulate models, rotate, move, work with Scene Inspector functions. I learnt how to texture objects, but I could not comprehend the LOGIX programming. It is visual programming in VR, and I found the LOGIX programming very difficult to learn. This case study was about how to organize movements of avatars in the virtual world in NEOS VR. I wanted to create restricted areas where avatars can get only by VR elevator. But that requires visual programming. This case study is still unfinished in VR. I tried to organize actions in virtual spaces, that is activity proper to architecture.
My method is research by design because I design, test and try new 3D models in VR. Each case study is the next step forward. At the beginning of the project, I never know what the result would be at the end. I interpret existing architecture and urban structure. I create VR Architecture.
I was designing three case studies, Architectural and Artistic spaces for Virtual Reality, VR Architecture. I used the social VR platform NEOS VR, where you can import the existing 3D models from Rhinoceros. But the very beginning of my research was creating my digital artwork, 3D models, renders, collages in 2D. Later I had ambitions to enter those 3D structures in virtual reality.
I was excited to interpret the site in Lisbon that I selected. I could visit personally in Lisbon, where I could spend two months in spring in 2019. The director of ISTAR, Assistant Professor Sara Eloy, accepted me for the visiting research at ISTAR-IUL. ISTAR-IUL is the Information Sciences and Technologies and Architecture Research Centre in Lisbon. I had contact with Sara from Professor Henri

Achten from CTU. I am grateful for this opportunity.
In my opinion, the environmental effects influence the design of VR Architecture very much. Local art and architecture were very influential. I had enough inspiration and information to build a new VR world in Neos VR.

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THE CASA DAS HISTÓRIAS PAULA REGO MUSEUM IN CASCAIS NEAR LISBON, PERMANENT COLLECTIONS VISITED IN JUNE 2019.

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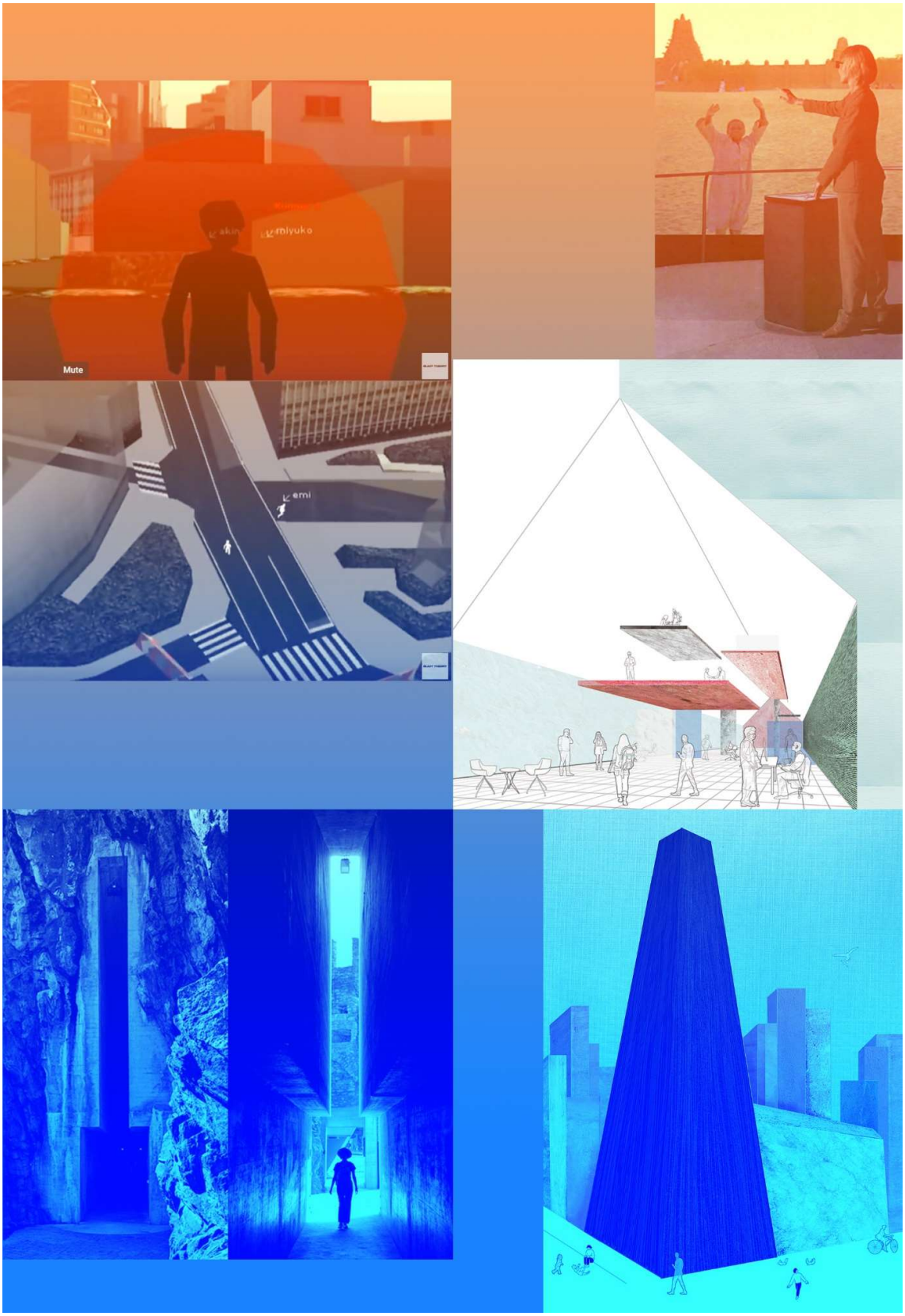
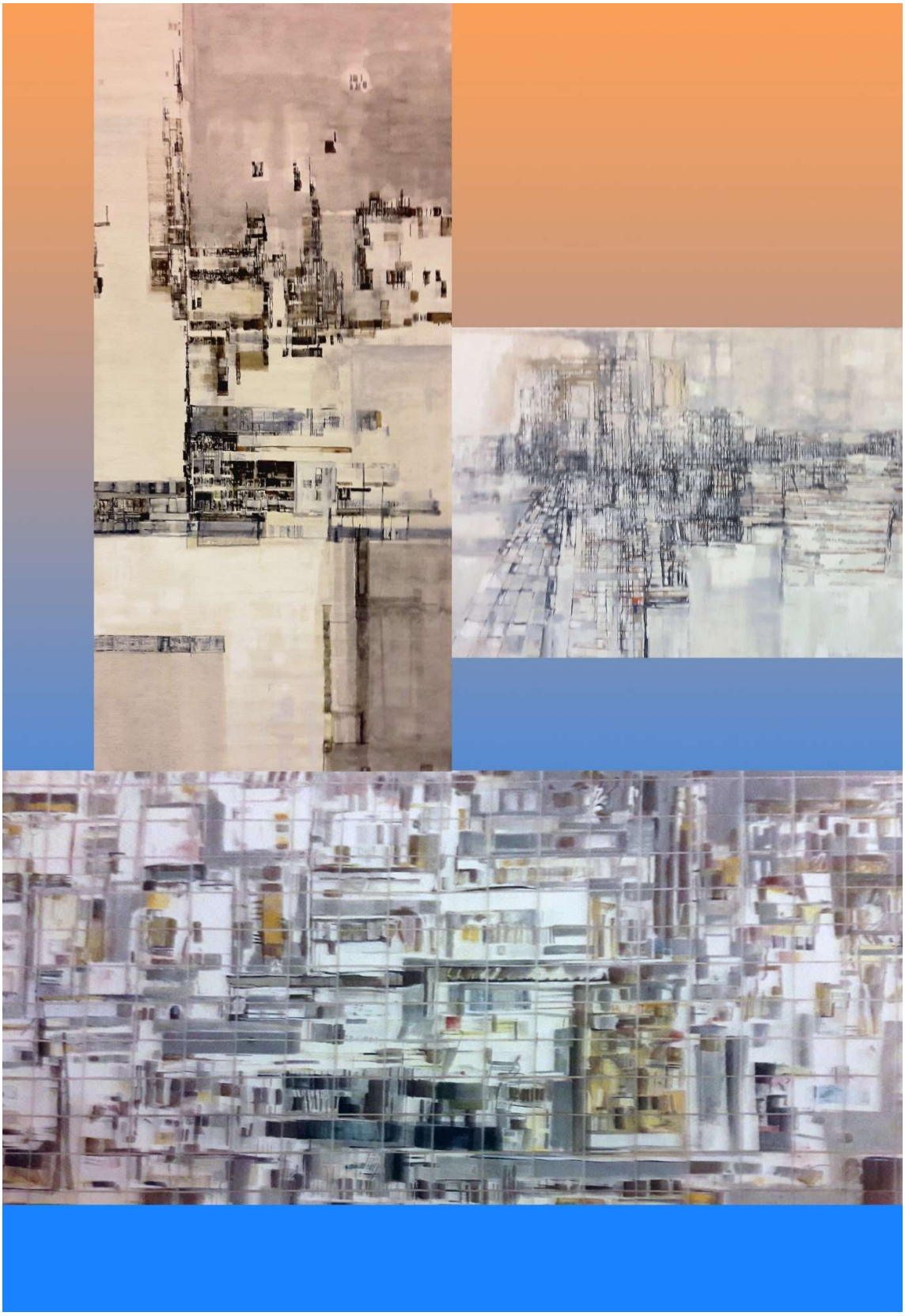
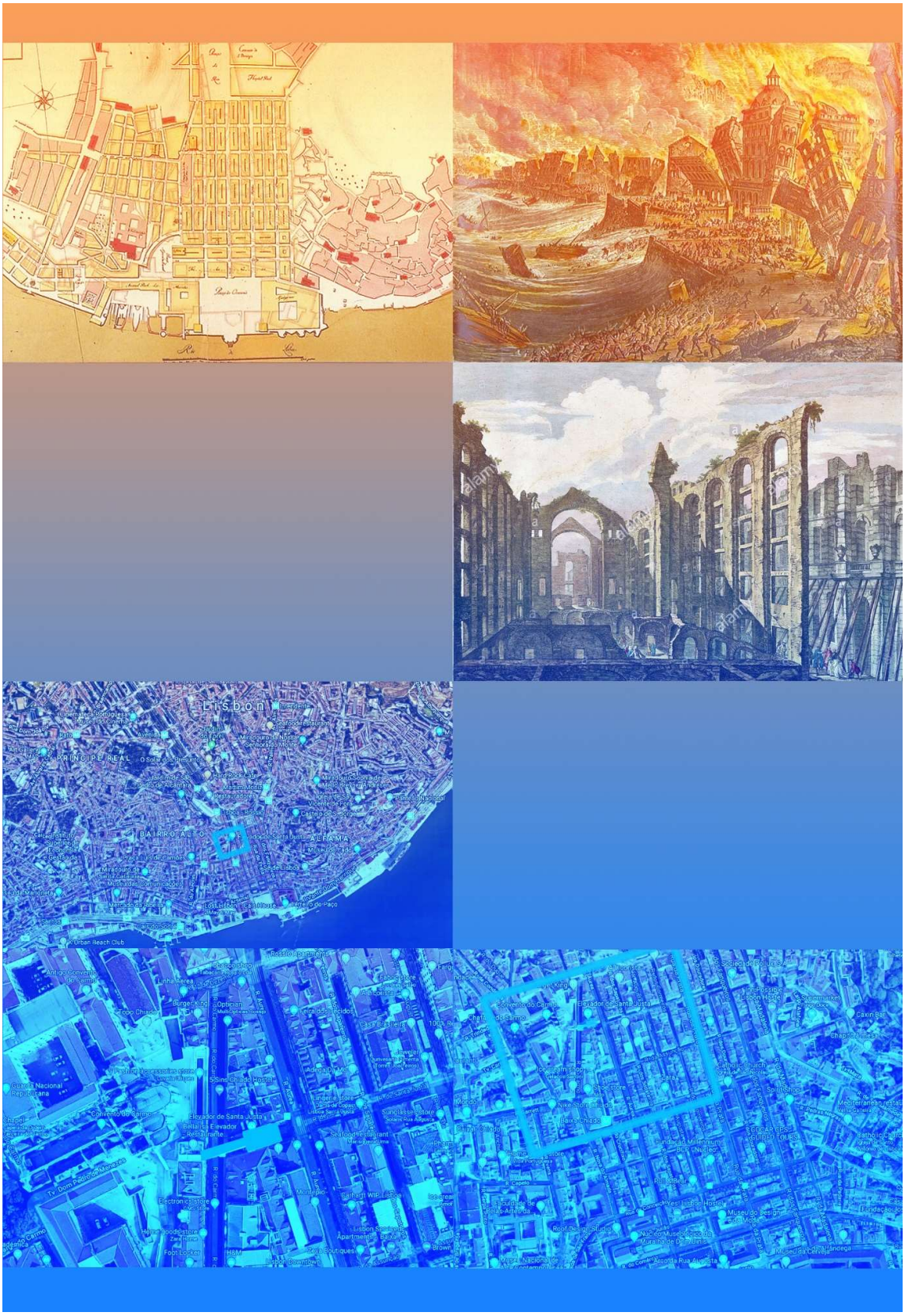


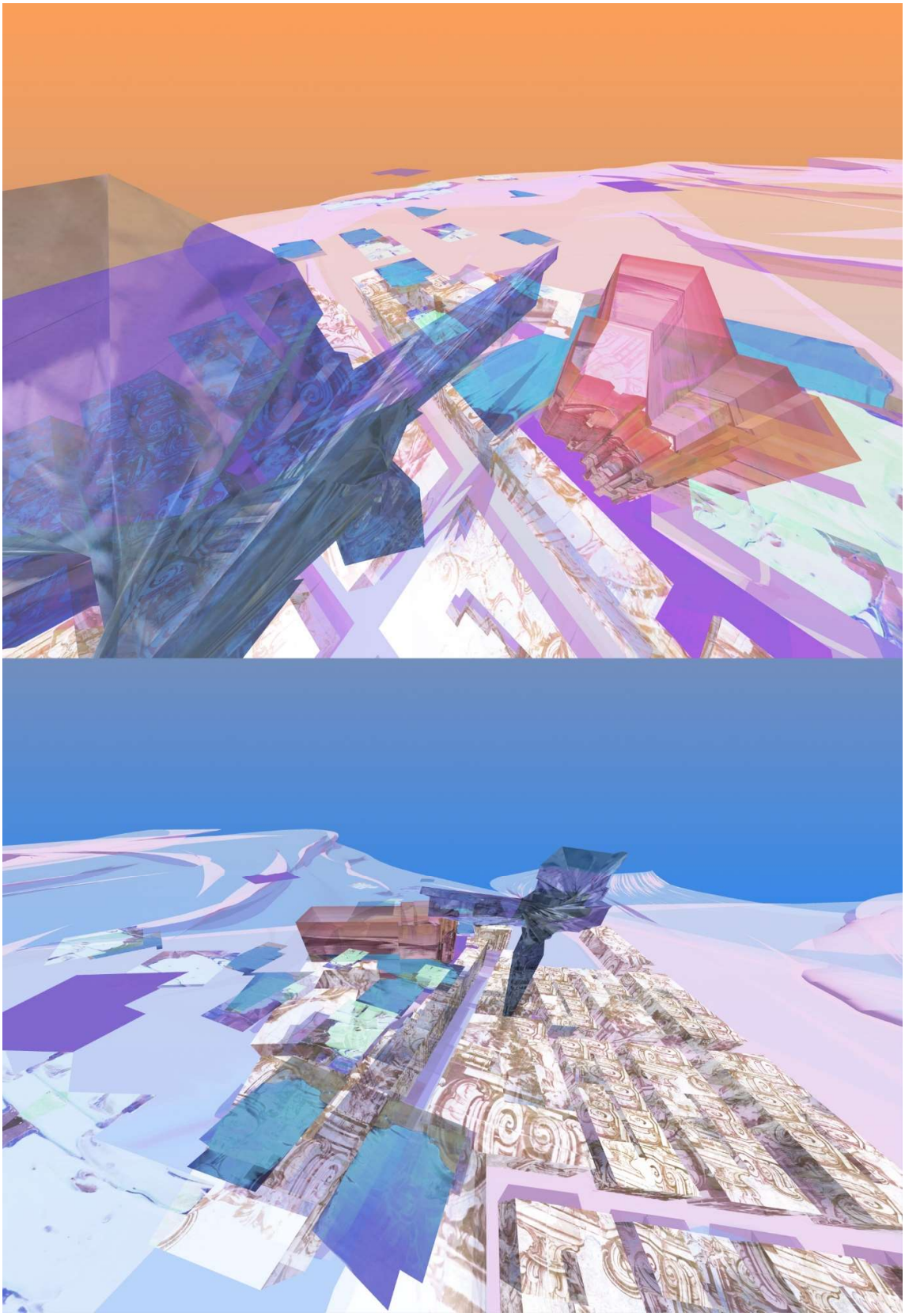
IMAGES FROM THE TOP LEFT: CAN YOU SEE ME NOW 2003 GAME, BE NOW HERE 1995, PROJECT MISTAKEN IDENTITY - MASHAL WAJID 2018, AURELIO'S GALFETTI LIFT IN CASTELGRANDE IN BELLINZONA 1981.



IMAGES BY HELENA MARIA DA SILVA - PAINTINGS INTERPRETATIONS OF CITIES AND HER ARTWORK FROM PAINTED TILES IN METRO RATO IN LISBON.



IMAGES FROM THE TOP LEFT: URBAN PLAN FROM POMBAL 1755 - BAIXA CHIADO AREA IN LISBON, TSUNAMI IN LISBON 1755, CARMO CONVENT AFTER THE EARTHQUAKE AND THE FIRE IN 1755, RECENT ARIAL VIEWS TO THE LOCATION WITH ELEVADOR SANTA DA JUSTA IN LISBON.



MARKÉTA GEBRIAN - PERSPECTIVE OF THE VR ELEVADOR IN RHINOCEROS WITH INTERPRETATION OF BAIXA CHIADO AREA IN LISBON.

MARKÉTA GEBRIAN - PHOTOS OF HOUSES FROM THE LISBON YELLOW TRAM RIDE, INSPIRATION FOR COLOURS OF MY VR 3D MODEL.

FINAL CONCLUSIONS:

In the past, we can see many inactions between art, cyber art and computer technology. With the development of VR technology, I see the need to design this virtual space. There is a Metaverse online that will be inhabited by millions of people in future. Right now, the attention is on social networks. Most people now have smartphones and tablets. Because the majority of Instagram or Facebook users has a smartphone. We can escape from reality when we get bored: we are standing in a queue in a shop, we are waiting for public transport, we are alone in a cafe or a bar, just because we have our smartphone connected to social networks. Many marketing firms now work with influencers, because they promote the goods or places to visit on Instagram. It is a new type of job. TV is no longer so interesting for the young population like it was in the past. TV is used in majority by older people who grew up with TV. My ideas and case studies are about the world that will happen in the future. VR technology and fast computers will be affordable in the next few years for the population. People who now own the computer have the perspective to possess VR glasses. Programmers in the majority use social VR platforms already, but it is not yet mainstream. Mainstream now is to have an account on Instagram or Facebook. Facebook developed Facebook Spaces, recently they invented the online Metaverse, Meta. Meta is a social VR platform for people with VR headsets. I see there is a problem there. Meta did not use the potential and possibilities to design experimental architectural virtual spaces that avatars can visit. I believe that we will arrange VR meetings, work in VR, shop in VR, go to offices in VR, manage daily duties in VR. All that could help us to gain time and we could use this time to spend real quality time together with family and friends. In addition, if we as architects and artists design these new VR worlds it could be a lot of fun to experience a new type of architecture, Architectural and Artistic Space for Virtual Reality, VR Architecture.

My improvements of the current situation in our “Meta Age”.

My ideas for future:

I would like to help to build the metaverse. We live in the turbulent and challenging times. There is still pandemic, coronavirus problem and yet I have to say that this problem of social distancing helped us to understand how much we need online digital spaces for meetings now mostly in 2D screens, but soon in 3D VR spaces online.
The Facebook company announced that they are opening about 10000 new job positions to create the project META. The name is from the word Metaverse.
In fact, this project is transforming 2D internet to the 3D online worlds where people will meet in the bodies of avatars. There 3D online meetings would absorb activities from physical world like work, education, shopping, socializing, games, and other entertainment activities.
Mark Zurkerberg said*:” Because of phones and cameras, the internet became much more visual. And recently as connections got faster, video has become the main way we experience content. We have gon from desktop to web, to phones, from text to photos to video. This isn’t the end of the line. The next platform and medium will be even more immersive. And embodied internet where you are in the experience not just looking at it. We call this the Metaverse. You will be able to do almost anything you*

can imagine. Get together with friends and family, work, learn, play, shop, create, as well as entirely new categories that don't really fit how we think about the phones and computers today… We believe the Metaverse will be the successor to the mobile internet. We will be able to feel present, like we are right there with people no matter how far apart we are We will be able to express ourselves in a new joyful completely immersive ways and that is going to unlock a lot of amazing new experiences.
…Instead of looking at the screen you are going to be in these experiences… It is about making the time we already spend on the screen better."
It is clear to me that another big step that is waiting for humanity is to move to online 3D worlds in VR. What does this do to the physical space? Activities proper to architecture will move to virtual worlds online. Not all of them. In my opinion it will have impact to the cities, where people were seeking the work, suddenly people will be able to live in remote places, isolated in nature and communicating with the world through the Metaverse. Work online from home, our, students had to work online from home, we all tried to live like this during the pandemic years. To me it seems that working and studying online is possible of course not for all jobs. That means that the need for the new technology like Metaverse is needed and has a great potential bring people together to collaborate online in immersive worlds. I wrote a comment to the keynote video of Mark Zuckerberg, that they should involve more architects and artist to design 3D spaces for online meetings. These 3D spaces need to be designed with a concept, ideas, imagination, knowledge of history of architecture and art. According to me these 3D spaces can't be random copies of some existing spaces. We are used to architecture in physical world. The built architecture has many rules and natural laws of gravity and statics that people need to follow to be able to build the houses. In virtual 3D online worlds, in Metaverse it is different.
We can do anything that is possible to build in 3D and program in VR, we can design interactive, changeable, moving spaces. Built architecture is rather rigid. VR architecture can be even more exciting for avatars because it is mathematical digital illusion, and we can leave it whenever we want. And architects can make changes quickly in 3D world, it is much easy to rebuild space in 3D than in physical world when building architecture.

In the conversation with Meta Company, I received this answer from Meta:

Markéta:

Hello, great video, thank You! I have suggestions for the Meta project. Do You work with top architects and artists to design spaces for VR meetings? Activities like work and education in VR are also activities proper to architecture, they are not games. Architects should design the Metaverse too in collaboration with VR specialists. In recent and contemporary architecture and utopian architecture, you can find much more exciting and spatially interesting spaces than You show in Your video about Meta. I think it is about mixing knowledge from architecture, art, and VR technology. The new type of architecture, VR architecture now emerges.

Meta:
Hi Markéta! The metaverse won't be built overnight by a single company, and many of the products needed to get into the metaverse will only be fully realized in the next 10-15 years. That said, we're taking the time now to ask difficult questions about how they should be built.

Markéta: Hello Meta team! I understand that it is a very long process, journey, just a similar one when 2D internet occurred and developed in years... In my opinion there will be people needed who design content, concept, and idea of spaces that programmers create. It will be 3D space where people will live, that is why I think people educated as architects are needed. Architect's study and design space in 3D. They might have answers how spaces for work and education, shopping etc. will look like in 3D in

VR. In Your recruiting website You are looking only for programmers and IT people for META project and that is a problem, I think. I love what You are building, I believe it is wonderful idea.

Over the seven years while I am writing this dissertation the technology advancement made huge step. In 2016/2017 VR headsets became mainstream and available in stores. Facebook company bought Oculus in 2014 and now Facebook creates Meta project, the 3D online VR spaces the Metaverse. I call our age in 2021 the Meta Age. The Age of the global 3D VR internet. And now we can ask how this 3D online VR worlds will look like.

In December 2021 I searched for new types of metaverses online. I found mostly game-oriented platforms using the crypto currencies. I found also one metavese for shopping online in 3D space. For examples:

Metaverse CEEK

CEEK presented H&M metaverse online 3D store, where avatars can experience clothing and retail shopping. In fact, its job for architect to design stores physical or virtual.

Decentraland

On their website they say: *"Create, explore and trade in the first-ever virtual world owned by its users."* These virtual worlds, 3D environment is designed as games and cartoons. I didn't find any connection to contemporary architectural designs in this metaverse, but in the future there might be a way how to design sophisticated VR worlds for gaming in metaverse.

Decentral Games

It is a social gaming platform, online casino in metaverse. Casinos are also spaces designed by architects in physical world. So why not design virtual casinos in metaverse.
"Decentral.games is a DAO-governed metaverse casino powered by $DG."

Illuvium Metaverse

Is metaverse with battle games, with fantasy animals like fairy dragons and dinosaurs. It is called fight for ETH. Also, the design is like fantasy 3D movies, it reminds me the film Avatar. The Youtube ILV video is a trailer showing how the metaverse looks like, the 3D environment, avatars, and fairy creatures. There is a ILV crypto currency info in Youtube too.

Bloktopia Metaverse

In the Bloktopia Metaverse is where you can learn, earn, play and create. Users can learn about crypto, earn by buying a real estate, rent it or resell it and earn cryptocurrency. Or users can do advertising and passive earning. Bloktopians can also relax and enjoy themselves, play with friends, compete, or create with some builder tool new scenes, artworks. You can win prizes in competitions too.

Enjin

"We're building a product ecosystem that will help humanity create advanced virtual economies through the power of blockchain technology."

Enjin is a metaverse, something like a virtual wallet using the blockchain technology. You can sell NFT's and assets for games or digital art too. It is gamer oriented too. Something like a virtual bank, architects can also design banks in metaverse. Soon Enjinn is opening 3D space, building in blocktopia.

Axie Infinity metaverse
Is a cartoon metaverse with battle type of activities where avatars can collect and earn. It is a metaverse with cartoon like characters.

Audio Metaverse
"The Audio Metaverse integrates the physical world into the virtual world through sound..."

In Audio Metaverse world is divided into cubes. Those cubes have owners. Owners of the cube can play music, sing, have discussions. User's voices interact with a three-dimensional grid, it creates a feeling of being in the same physical space.

I can go on and name another metaverse projects like Sandbox, where avatars can play, create, own, and govern a virtual Metaverse made by players or I name games on WAX.

What is the most important is that as user of those metaverses, you can buy and sell assets or NFTs. NFTs are images, videos, music, or assets for games. In some metaverse you can also buy a land a build your own house or project. There is a whole new world of digital files, that you can buy in metaverse. Why to buy assets in metaverse? It is a similar situation like in physical world, we buy things for use and status. We buy hoses to show our status in society. Virtual worlds work similarly.

What is interesting for VR architecture is that architects like Zaha Hadid Architects are involved in metaverse projects. They created a video in December to show Cyber Urban Crypto Incubator, Liberland Metaverse. It is a project where people trade crypto currencies. It looks like a visualisation of the part of the city with trees, river, green spaces, buildings, towers, all that could be constructed. Avatars walk on the ground, there are staircases, columns. There is a city hall, DeFi Plaza, DeFi Incubator, NFT Plaza, Exhibition. In Exhibition are some artworks hanging in the space without a support. It is a sign of metaverse, but it looks like the only one that shows possibilities without gravity.

Vault – The World's First Social Currency
The Vault holds some of the most rare and valuable NFTs across blockchain gaming, digital art, virtual real estate and other highly coveted digital collectibles.
The Vault is audited regularly by the reputable NonFungible.com team to provide clarity and transparency to all $WHALE holders.

What Is a Bitcoin Whale?

A bitcoin whale is a cryptocurrency term that refers to individuals or entities that hold large amounts of bitcoin. Whales hold enough cryptocurrency that they have the potential to manipulate currency valuations.

Blockchain games like for example: Sorare, Gods Unchained, Beyond the Void, CryptoKitties, My Crypto Heroes and Spells of Genesis are games that use cryptocurrency, but they are not metaverse games.

"Collectible card-battling, cartoon cat wrangling, and historical hero hunting—these diverse games all use blockchain to create unique experiences."

Dictionary

“What is blockchain?

Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system.

A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain. Each block in the chain contains a number of transactions, and every time a new transaction occurs on the blockchain, a record of that transaction is added to every participant’s ledger. The decentralised database managed by multiple participants is known as Distributed Ledger Technology (DLT).

Blockchain is a type of DLT in which transactions are recorded with an immutable cryptographic signature called a hash.”

cryptography (n.)
1650s, "art of writing in secret characters," from French cryptographie or directly from Modern Latin cryptographia, from Greek kryptos "hidden" (see crypt) + graphia (see -graphy).
Related: Cryptographic; cryptographer.

crypt (n.)

early 15c., cripte, "grotto, cavern," from Latin crypta "vault, cavern," from Greek krypte "a vault, crypt" (short for krypte kamara "hidden vault"), fem. of kryptos "hidden," verbal adjective from kryptein "to hide," which is of uncertain origin. Comparison has been made to Old Church Slavonic kryjo, kryti "to hide," Lithuanian kráuti "to pile up." Beekes writes that krypto "is formally and semantically reminiscent of [kalypto]; the verbs may have influenced each other." For this, see calypto-. But he adds, "However, since there is no good IE etymology, the word could be Pre-Greek." Meaning "underground burial vault or chapel in a church" is attested by 1789.

-graphy

*word-forming element meaning "process of writing or recording" or "a writing, recording, or description" (in modern use especially in forming names of descriptive sciences), from French or German -graphie, from Greek -graphia "description of," used in abstract nouns from graphein "write, express by written characters," earlier "to draw, represent by lines drawn," originally "to scrape, scratch" (on clay tablets with a stylus), from PIE root *gerbh- "to scratch, carve" (see carve). (etymonline.com)*

cryptocurrency

a digital currency in which transactions are verified and records maintained by a decentralized system using cryptography, rather than by a centralized authority.

"decentralized cryptocurrencies such as bitcoin now provide an outlet for personal wealth that is beyond restriction and confiscation"

Definitions from Oxford Languages

Future of the VR Technology

On February 26th, 2020 Tesla presented online a video on Youtube about Teslasuit / Master Reality. Teslasuit is a human digital interface, it is the suit for virtual reality that simulates haptically inputs between physical world, human body and virtual world. The suit helps and can accelerate VR training for professions like fireman, jobs in industry and research, etc. Training with Tesla suit requires less time, but so far, the promotion was not showing the use online in the metaverse.

Furthermore, in order to accurately capture facial expressions, body language and voice quality, people will need expensive technical equipment, ie communication can be done not only without VR headsets, but also gloves for sensing movement and suits / overalls. It takes quite a long time to put on some suits for VR with sensors and vibrators.

Bhaptics.

Audio-based Haptics. Our unique Audio-to-Haptic technology converts sound into haptic feedback in real time. Add haptics to all the content you love and enjoy sound-based haptic feedback with your favorite games and movies.

"Experience powerful, yet sophisticated haptic feedback delivered by 40 haptic points wrapped around your upper body."

Smartsuit Pro II

The "metaverse" issue is not limited only to Meta / Facebook company. As I mentioned also other companies are also working on it, eg Microsoft is working to add 3D avatars and other elements to its working software Teams. *Workplace is an online collaborative software tool developed by Meta Platforms. It facilitates online groupwork, instant messaging, video conferencing, and news sharing.* The estimate is that, for example, in few years, most online meetings will move from a 2D screen to the 3D space metaverse with digital avatars.

The idea is that eventually everyone will have their own VR headset or other VR device and will connect to the metaverse with own avatar for meeting people in virtual space for activities like work, studies, socializing.

What is important for architecture from this topic of the metaverse and VR worlds?

In fact, there are many similar features between virtual VR worlds in the metaverse and our physical world where we build architecture. Number one is that we can buy land and construct a project, architecture in the metaverse. We can buy 3D space in metaverse projects or we can inhabit and create VR world for free like in NEOS VR. We can use cryptocurrency, virtual money to buy land, lot, 3D space, we can buy 3D assets for cryptocurrency. That is so like physical world, land, money, building architecture. The question is the design of the 3D architecture for the metaverse. I came

across to projects in the metaverse that they copy our physical world and designers do not behave freely in VR world. The potential and the imagination of how virtual worlds in metaverse can look like is not fully developed. In my work I tried to look from different perspective at this design issue of VR architecture. During the pandemic I have spent 6 months as a visiting scholar at North Carolina State University in Raleigh as a Fulbright scholar. My visiting research was about how to design VR classes online in the metaverse, because during the Coronavirus crisis most of the schools and universities were closed. Teachers and students had to face the challenge that classes became online on Zoom, Teams and other 2D online platforms. Our classes at Czech Technical University in Prague at Faculty of Information Technology were also online in Neos VR metaverse. Those classes happened in 3D online worlds in Neos VR in virtual reality. I was much more exciting that to observe talking heads on Zoom calls. In Raleigh I decided to get inspired from local, amazing library designed by Snohetta office and I was inspired from Neos VR online classes at CTU Prague. I will now explain the project in detail. It is my point of view, my opinion, how we can design as architect's online 3D VR internet for avatar meetings with the purpose of education.

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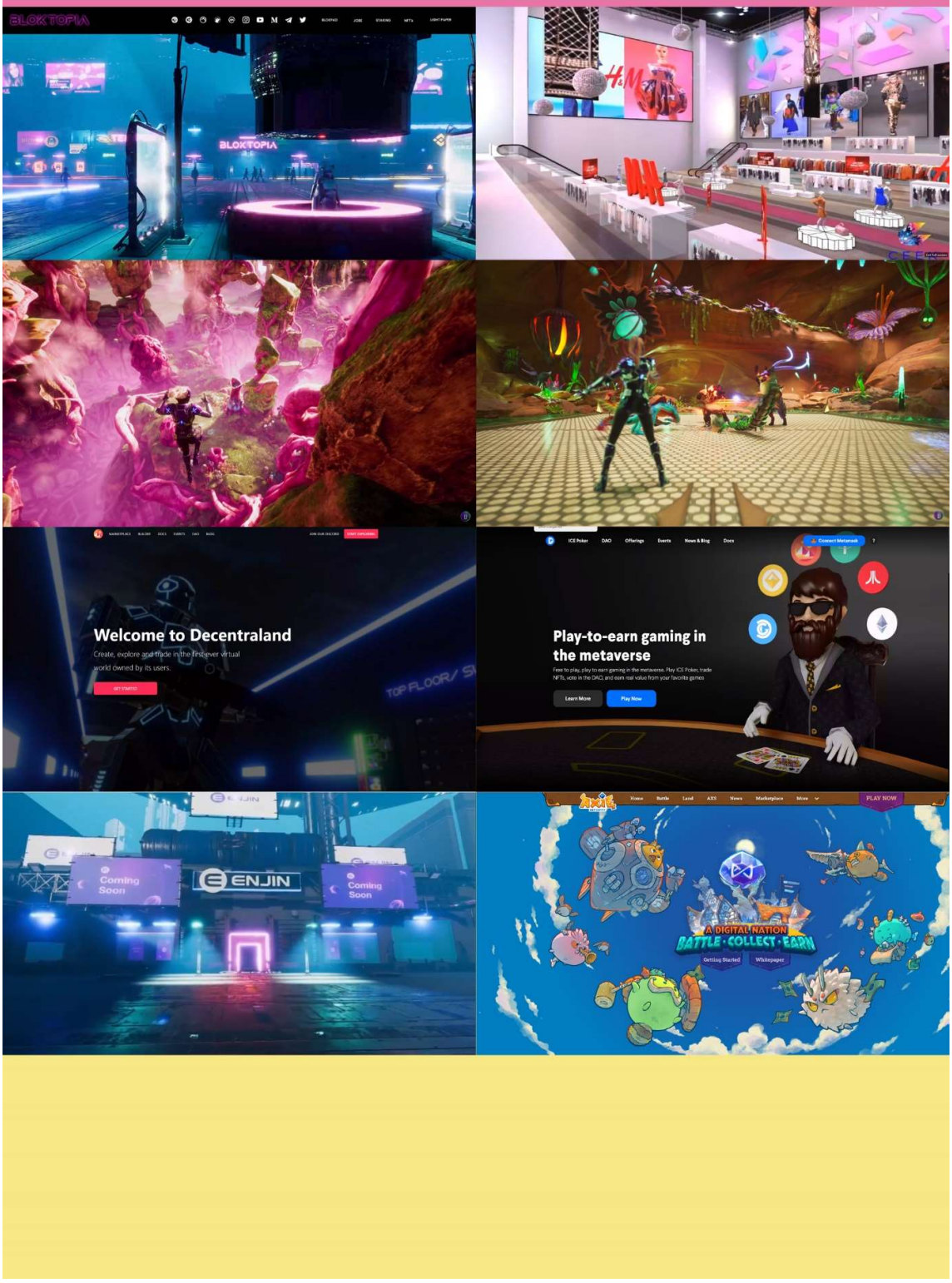
IMAGES FROM NEOS VR METAVERSE – IMAGES FROM THE TOP DIFFERENT AVATARS IN VR WORLDS, NEOS HUB AND VR CLASSES WITH THE TEACHER PETR KLÁN FROM FIT CTU.



OTHER TYPES OF METAVERSE – IMAGES OF METAVERSE FROM THE TOP: BLOKTOPIA, HM STORE IN CEEK, ILLUVIUM, DECENTRALAND, DECENTRALGAMES, ENJIN, AXIE

MARKÉTA GEBRIAN VR CLASSES WITH FLOATING LEVELS AND THE DEFORMED SHELL, AVATAR COMMUNICATION. JUNE 2021.

Conclusion for Further Development of Science and for Implementation in Practise:

VR SPACES FOR EDUCATION IN THE METAVERSE/VR CLASSES.

Raleigh, June 2021.

VR Architecture Project / Avatars in the Shell - Fulbright programme: Visiting Research at North Carolina State, College of Design, Department of Art and Design.

Supervisor: Derek A. Ham, PhD.
Assistant Professor.

Concept for VR Space: My concept was to create VR classes, spaces for online education in the metaverse, that are accessible in Neos VR. These VR spaces are inspired by the robotic Hunt Library at North Carolina State University in Raleigh in the USA designed by Norwegian architectural office Snohetta. VR Architecture is architecture for 3D spaces, buildings in the metaverse. Architecture should quickly reflect the change that is happening in our digital era. We work and study online on Zoom calls, video conferences with our colleagues. We use online banking, book our holidays online, shop online, we navigate with maps online every day. We are architects, designers, artists. We should design architectural and artistic 3D space in virtual reality, the 3D internet, the Metaverse. Architecture and Art are disrupted disciplines in the metaverse because laws of gravity and statics do not apply here. My concept is to put avatars in the shell that will react on the number of avatars in this space connected online. There will be fixed static part, VR floors and VR walls floating in space reminding of physical classrooms. There will be shell scaling its shape according to the movements of avatars inside.

"shell (n.) Old English *sciell*, *scill*, Anglian *scell* "seashell, eggshell," related to Old English *scealu* "shell, husk," from Proto-Germanic **skaljo* "piece cut off; shell; scale" (source also of West Frisian *skyl* "peel, rind," Middle Low German *schelle* "pod, rind, egg shell," Gothic *skalja* "tile"), with the shared notion of "covering that splits off," from PIE root *skel- (1) "to cut." Italian *scaglia* "chip" is from Germanic. Sense of "mere exterior" is from 1650s; that of "hollow framework" is from 1791. Meaning "structure for a band or orchestra" is attested from 1938. Military use (1640s) was first of hand grenades, in reference to the metal case in which the gunpowder and shot were mixed; the notion is of a "hollow object" filled with explosives. Hence *shell shock*, first recorded 1915. *Shell game* "a swindle" is from 1890, from a version of three-card monte played with a pea and walnut shells." https://www.etymonline.com/search?q=shell

avatar (n.)
1784, "descent of a Hindu deity to earth in an incarnate or tangible form," from Sanskrit *avatarana* "descent" (of a deity to the earth in incarnate form), from *ava-* "off, down" (from PIE

root **au-* (2) "off, away") + base of *tarati* "(he) crosses over," from PIE root *tere- (2) "cross over, pass through, overcome."
Meaning "concrete embodiment of something abstract" is from 1815. In computer use, it seems to trace to the novel "Snowcrash" (1992) by Neal Stephenson." https://www.etymonline.com/search?q=avatar
I want to build an inhabitable educational space in VR, is that architecture? Or art? Ot is that new type of architecture VR Architecture?

Keywords

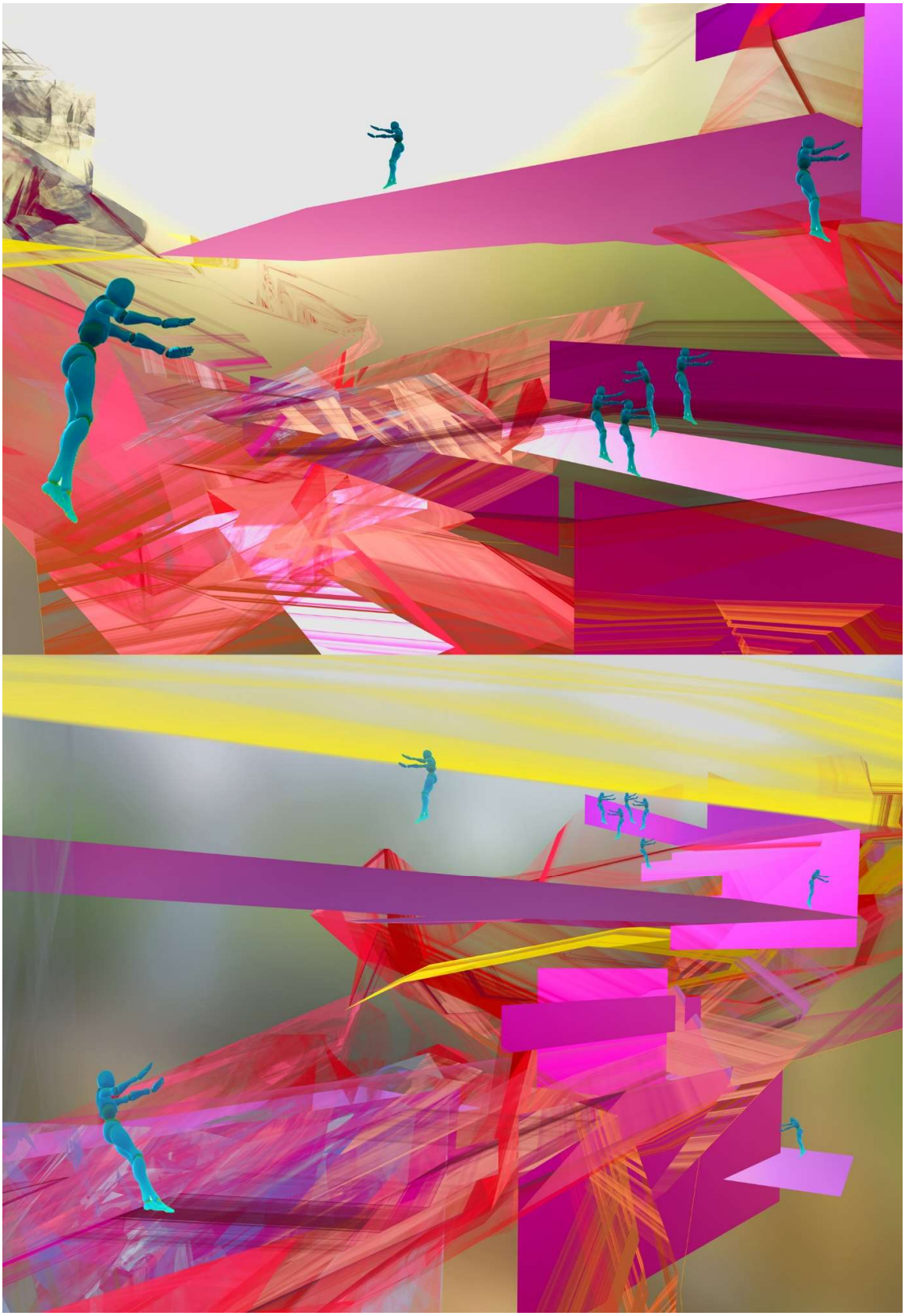
Virtual worlds. Virtual environments. Virtual space. Virtual reality. Architecture Through VR. Interpretation. Digital art. Generative Arts. NEOS VR.

Design Process:

Type of results: Digital 3D model in Blender, renderings, digital art, 3D object in virtual reality plus video records from NEOS VR and UNITY. Functional virtual reality world with interactive 3D object in UNITY.
Topic: I want to create virtual 3D space for educational purposes that will be inhabited by avatars online. Something like a temporary online architecture that exists in two different modes. When the architecture is not used by avatars the building would be only a static shell with core VR walls and VR floors, simple surfaces. But this shell would scale when the space would be inhabited by more avatars in VR. Avatar simplified to the sphere if he would approach the Shell the Shell would scale, grow away from the sphere.

Dimensions: 3D model is derived from the physical sizes of the Hunt Library, so it has size as a building.
Composition: There are static and interactive elements. I designed the VR floors and VR walls first, then I designed the Shell around these floating elements. Shell would, scale, transform, grow from positions of the sphere heads of avatars.

Size: I wanted the size of the 3D structure to be like the real size of the Hunt Library. I redraw shapes of the group study spaces in the Hunt Library and created surfaces from polylines in the Rhinoceros program. I moved the in the space intuitively to create floating walls and floor's structure. In Blender I transformed, sculpted the surface of the Shell. I textured the shell and left the VR floors and VR walls in one magenta colour. I worked with colourful textures to imitate the transparent but colourful Shell. I worked in 2D with the renders, and I created short testing animations. I use research by design. I experiment with a 3D model in Blender and Rhinoceros, plus NEOS VR. I love to use very light, transparent textures on single surface that creates a thin shell. I like to test spaces that are impossible to construct in the physical world as architecture. My dream of colourful, floating, transparent, and moving light structure is possible in VR space. The shape of the shell grows and transforms as a new avatar inhabit the VR space. I imagine if the avatar would be simplified as a sphere the shell would grow bigger about 3 meters on each direction from the avatar sphere. I choose 3m because it is a size of the common floor height in architecture.



MARKÉTA GEBRIAN - AVATARS IN THE VR SHELL, VR CLASSES WITH FLOATING WALLS. JUNE 2021.

Because the basic shape of the shell of this VR architecture is not symmetric it could generate interesting 3D structure.

Year of creation: 2021.

Task: To test educational spaces online that has core floors and walls plus shell that is interactive and transform them into virtual reality. She space would be used temporarily when some avatar would be inhabiting it. It would be space for education, but also for meetings of students just for social purposes. I want to design a 3D object with textures that are mostly transparent but still colourful by using alpha channel of the textures. These attributes are very rare in constructed architecture in physical world so let's use them in virtual reality.

Location of the Project: Inspiration is the Hunt Library at NC State, but the project is in virtual reality in UNITY and NEOS VR.

Inspirations by Shape and Colours:

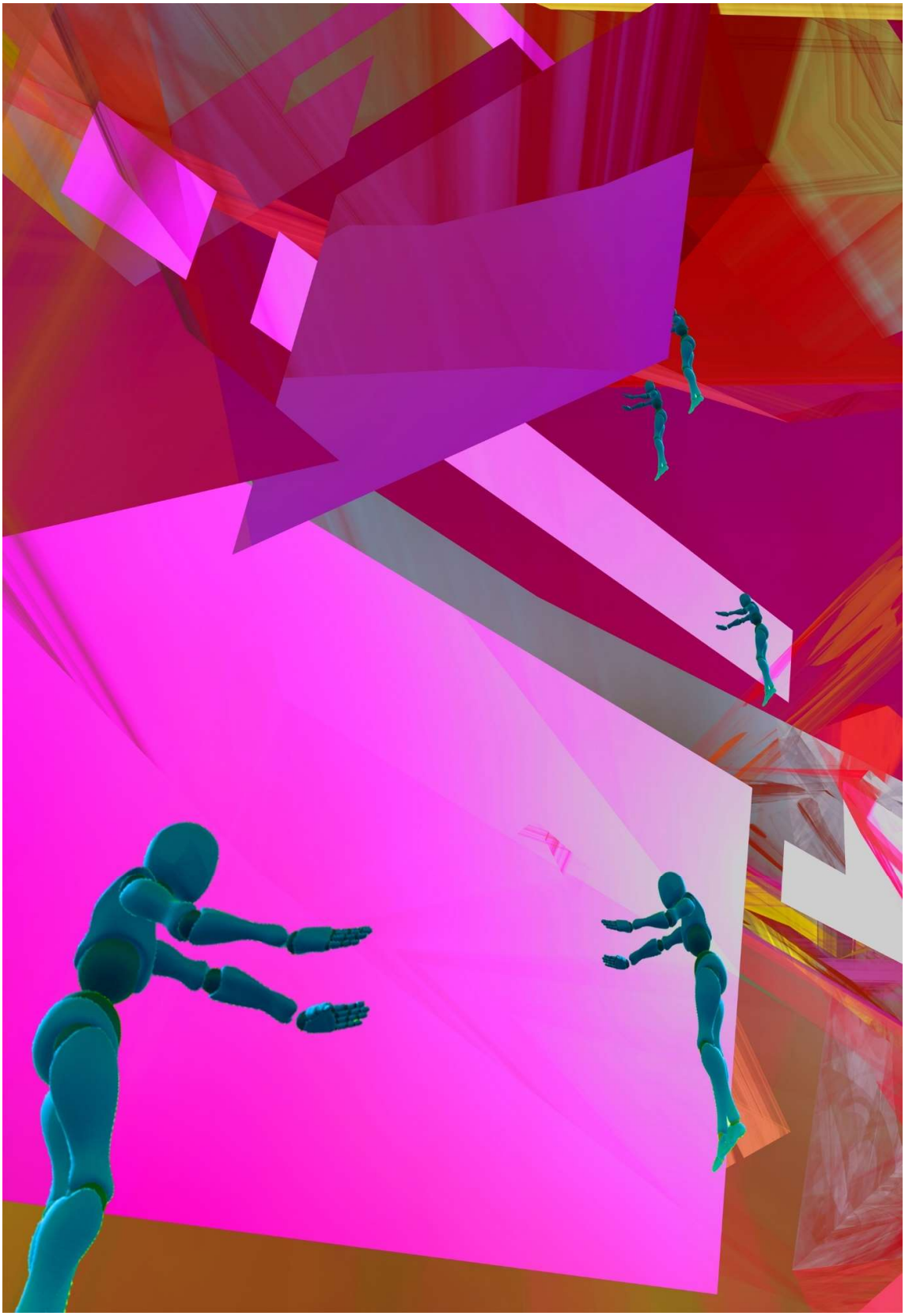
Colours found in the exterior and interior of the Hunt Library

Since my childhood, I was fascinated by colours, I have my favourites, pink, magenta, violet and yellow, also red, and light blue. I wanted to find a colour scheme by looking in the interior of the library and in the exterior and I found beautiful magenta blossom of the trees next to the library. There are beautiful yellow stairs and colourful furniture and carpets. All these colours are my inspiration.

References to Architecture:

Hunt Library

"*In 2013, North Carolina State University officially dedicated the James B. Hunt Jr. Library. Snøhetta worked closely with NCSU Libraries to set a new benchmark for technologically sophisticated collaborative learning spaces with the design of the new Hunt Library. It serves both as NC State's second main library and the intellectual and social heart of the university's Centennial Campus plan. The Hunt Library also houses the Institute for Emerging Issues, a political think tank led by former North Carolina Governor James Hunt, academic offices, and an auditorium. It is designed to be a decisive competitive edge for the university by democratizing access to the technologies driving our economy. Libraries are dynamic and continually changing. While clearly a contemporary structure within a traditional context, the Hunt Library provides a forward-thinking platform for influencing its surroundings. Both technical and programmatic innovations are celebrated as part of the learning experience and provide a versatile and stimulating environment for the user."* Snøhetta architects.
I love the Hunt Library, because it combines the technology, robotic, interactive parts, and exciting architecture for students to use as a group study space and individual study space. That is why I choose this building. Hunt Library was my source of inspiration. To see those colours and lights inside was exciting. There was red, magenta, violet, pink, yellow, bright furniture on the ground floor, all colours I love. And there was this mixture of colours and light, transparency, and facility. What made this effect of this tall space was the light coming through the façade with panels for shading from the sun. It looked like a white pace with strips of shadows and colours on the ground. I designed my VR classes according to lightness, colours, and



MARKÉTA GEBRIAN - AVATARS IN THE VR SHELL, VR CLASSES WITH FLOATING LEVELS AND WALLS. JUNE 2021.

transparency principles. I wanted to achieve space with alpha channel textures in 3D because, in the physical construction, it is hard to construct lightness and transparency with colours at the same time in one space.

References to Art:

Zaha Hadid Early Paintings and Drawing in Serpentine Sackler Gallery 2017

*"I have always been interested in the concept of fragmentation with ideas of abstraction and explosion, deconstruction ideas of repetitiveness and mass production. My work firstly engaged with Russian avant-garde, in particular with work of Kazimir Malevich- he was an early influence for me as representative of the modern avant-garde intersection between art and design. Malevich discovered abstraction as an experimental principle that can propel creative work to previously unheard levels of invention: this abstract work allows much greater levels of creativity. "*Zaha Hadid 2007
In my opinion todays digital tools make possible to explore new levels of creativity with the help of design computing, coding, and other types of programming. This new type of computer aesthetic helps open our minds to the exciting creative solutions. Zaha Hadid architects in the collaboration with Google Arts and Culture developed exhibition of experimental virtual reality experience in 2017.

Frank Stella - 3D Printed Sculptures

"Stella's decades-long career is synonymous with artistic innovation. From his early Black Paintings, which dramatically shifted the dialogues on abstract art, to his use of both the formal qualities of painting and sculpture to produce his Polish Village series in the 1970s, and through to his use of computer modeling and 3D printing, from the 1990s and into the present, Stella has continued to push compositional boundaries. His experimentation with and use of line, colour, and form have resulted in strikingly different effects—on the canvas and in three dimensions. Stella's boundless vision has resulted in a new body of work that freshly engages the grid as well as the star and ribbon motifs that have appeared throughout his oeuvre." ArtfixDaily Artwire I love Frank Stella's work; he was mainly a painter but recently he creates statues and uses 3D printing, digital tools and that is I think the future.

Fefik Anadol - WDCH Dreams

"The Los Angeles Philharmonic has collaborated with media artist Refik Anadol to celebrate our history and explore our future. Using machine learning algorithms, Anadol and his team has developed a unique machine intelligence approach to the LA Phil digital archives – 45 terabytes of data. The results are stunning visualizations for WDCH Dreams, a project that is both a week-long public art installation projected onto the building's exterior skin and a season-long immersive exhibition inside, in the Ira Gershwin Gallery.
To make Walt Disney Concert Hall "dream," Anadol utilized a creative, computerized "mind" to mimic how humans dream – by processing memories to form a new combination of images and ideas. To accomplish this, Anadol worked with the Artists and Machine Intelligence program at Google Arts and Culture and researcher Parag K. Mital to apply machine intelligence to the orchestra's digital archives – nearly 45 terabytes of data." Refik Anadol studio.
Refik Anadol is progressive artist who works in the team of programmers, IT specialists and architects. They use huge number of data as starting point for their art. It could be image files, video files, metadata files and audio files. Then they use coding, machine-learning algorithms to transform and work with those data. The results are immersive and interactive installations and "datasculptures". I think that is amazing to turn data into something aesthetic, futuristic art.

References to Films:

2017 Ghost in the Shell
This is a film about the future, people have cybernetic improved bodies. The corporation Hanka Robotics works on a secret project to develop an artificial body, or "shell", body with a human brain and robotic shell." I love this movie because of the visual pictures of the city in near future in Japan. AI elements looks like colourful hallucinations of different realities. I love idea of a brain in the robotic shell.

Design and Conditions for Programming:

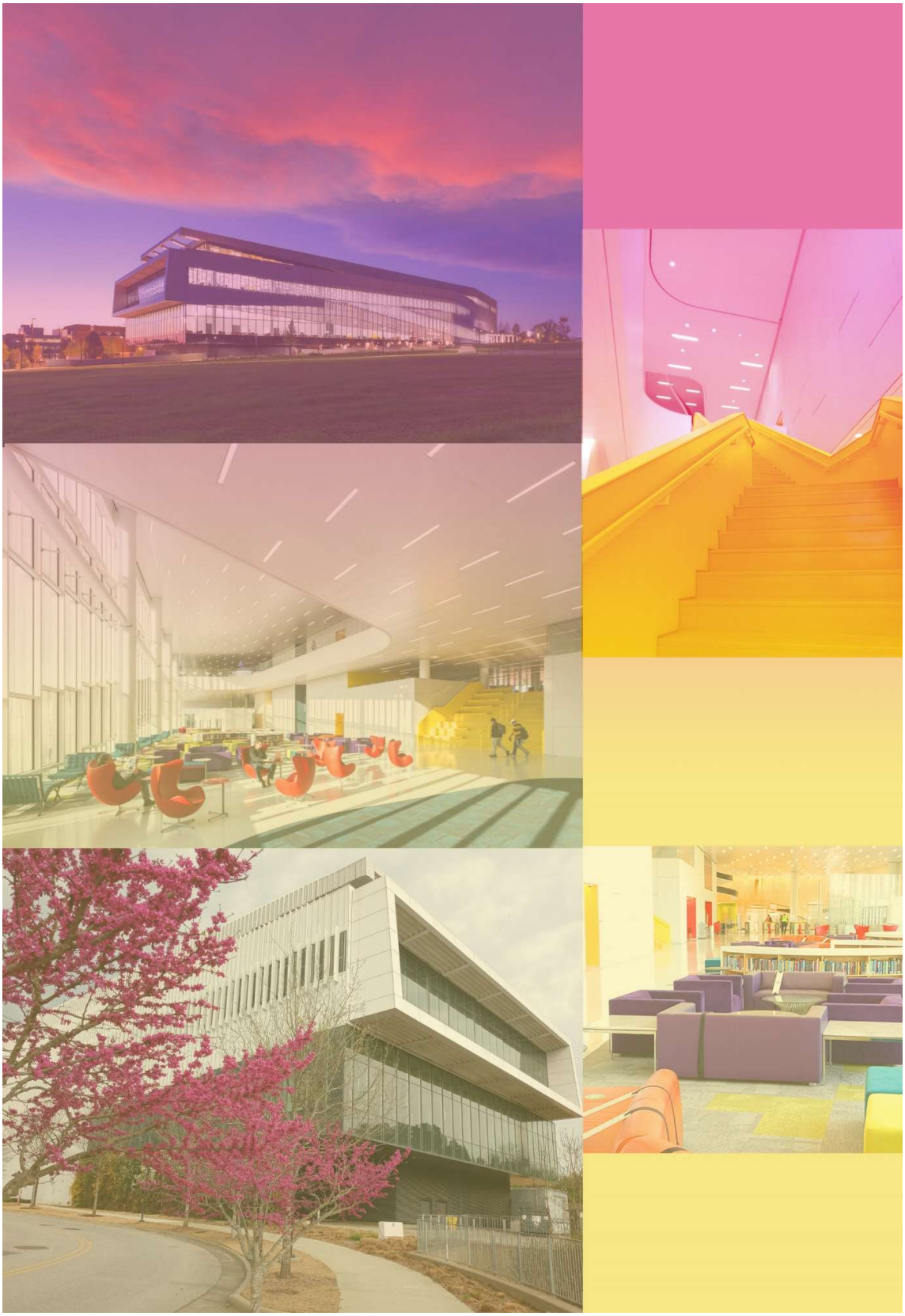
Design Ideas: Step one – I was the be inspired by the architecture of Hunt Library and the film Ghost in the Shell. I loved the colourful shining spaces with AR advertisements in the city. I wanted to use as many colours in this project as possible. I wanted to create structure, 3D object that would look like a massive shell and avatars in virtual reality would fly inside and create the shape of the interactive shell. I used static floating floors and walls that I took from the shapes of floorplans of the Hunt Library. I designed intuitively the shell of the space around the floating floors. The reason was that shell can offer an intimate space, but it depends on the number of users that would be inside the shell. The shell is transparent mostly but, in some areas, there are textures with colours. I wanted to create space as light as possible but colourful.
Structure: Horizontal thin floors, vertical thin walls with monochrome colours. Shell is created in Blender by sculpting from polysurfaces, this polysurface has texture with colours taken from the Hunt Library and I also used a alpha channel to create transparencies.

Conditions, Type of Interactions for programming the Interactive Shell:

I imagine an avatar is a simplified 3D object in VR, avatars head is a sphere. I would program the Shell of the VR building so the Shell transforms when the sphere gets closer to the shell from inside. The shell would be scaled around the sphere head of the avatar for the distance 3 meters. I choose 3m because in architecture it is a most common level height of the building. It is an idea that more avatars inhabit a shell, VR architecture the bigger the VR space gets.

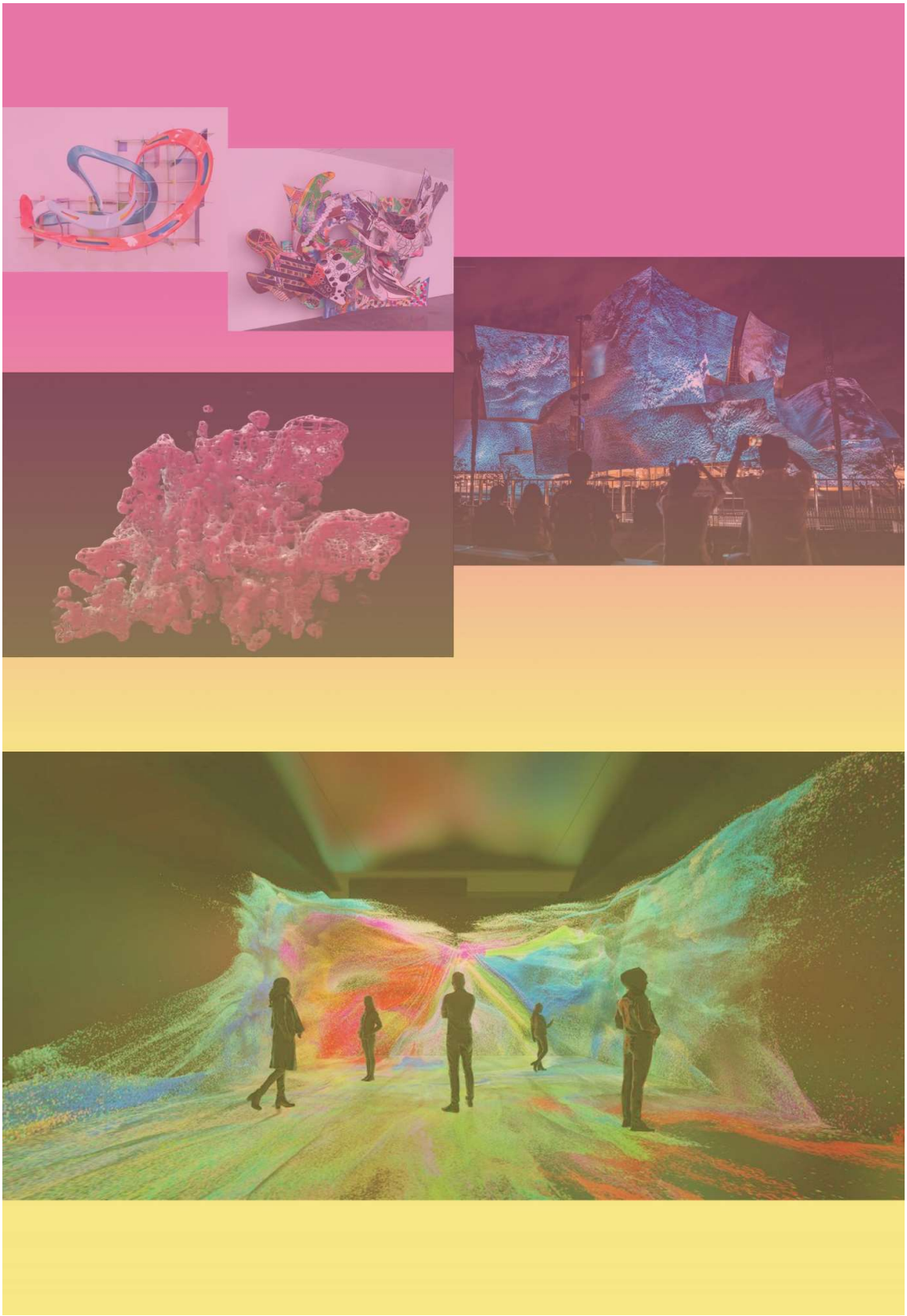
The VR walls and VR floor would remain the same and static because they should represent the meeting and orientation points in VR.

MARKÉTA GEBRIAN VR - CLASSES WITH FLOATING LEVELS AND WALLS. VR ONLINE CLASSES. JUNE 2021.



IMAGES FROM THE TOP: THE HUNT LIBRARY MOOD AFTER SUNSET, INTERIOR FULL OF LIGHT WITH COLOURFUL FURNITURES, YELLOW STAIRS, PHOTOS BY SNØHETTA ATCHITECTS. THE HUNT LIBRARY INSPIRATIONS: MAGENTA TREES, FAÇADE, INTERIOR. PHOTOS BY MARKÉTA GEBRIAN.

DRAWINGS OF THE HUNT LIBRARY, MAGENTA SPACES ARE FOR GROUP EDUCATION, YELLOW SPACES ARE SPACES FOR FORBOTS, HUNT LIBRARY PLANS BY SNØHETTA ARCHITECTS.



IMAGES FROM THE TOP LEFT: FRANK STELLA – MARIANNE BOESKY GALLERY MONUMENTAL SCULPTURES / USE OF 3D PRINTINIG, 2019. ONUR YUCE GUN – BREATHE - CLOUD TECTONICS / OIL PAINTING+ MACHINE LEARNING 2021. REFIK ANADOL – WDCH DREAMS – LA PHIL 2018/2019. MACHINE MEMOIRES: SPACE 2012.

Summary:

For me, this case study concludes that the test study for interactive environments in VR because there you can meet other avatars and communicate with them and study together, give lecture with uploaded slides, photos, videos on VR walls. It should make me feel avatars to stay longer in virtual environments with human interaction. I want to interpret the architectural spaces of the Hunt Library into architectural and artistic space for virtual reality, because built environment is a source of interesting data to work with in the computer.

My goal is to:

Test interactive environments in VR with imported 3D models in the Unity.
Interpret data from reality, architecture into artistic and architectural spaces in 3D in VR. Create new VR Architecture in Metaverse and design Architectural and Artistic Spaces through virtual reality.

References:

SNOHETTA (2013). RETRIEVED 25TH, JANUARY 2022 FROM HTTPS://SNOHETTA.COM/

ETYMONLINE. RETRIEVED 25TH, JANUARY 2022 FROM HTTPS://WWW.ETYMONLINE.COM/

ZAHA HADID ARCHITECTS (2016). RETRIEVED 25TH, JANUARY 2022 FROM HTTPS://WWW.ZAHA-HADID.COM/2016/12/07/ZAHA-HADID-EARLY-PAINTINGS-AND-DRAWINGS/

REFIK ANADOL STUDIO (2018). RETRIEVED 25TH, JANUARY 2022 FROM HTTPS://REFIKANADOL.COM/WORKS/WDCH-DREAMS/?I=D

THERE ARE VIDEOS THAT PRESENT NEOS VR OR VARIOUS WEBSITES:

NEOS VR. HTTPS://NEOSVR.COM/

HTTPS://WWW.INDIEDB.COM/GAMES/NEOS-VR/VIDEOS/NEOS-VR-BETA-LAUNCH-TRAILER-2

HTTPS://STEAMCOMMUNITY.COM/APP/740250/VIDEOS/

THERE ARE SOME SAMPLES OF THE TUTORIALS FOR VISUAL PROGRAMMING IN NEOS VR:

YOUTUBE CHANNEL ON NAME FROOXIUS.

Image Sources:

FRANK STELLA - SCULPTURES. IMAGES RETRIEVED 27TH JUNE 2021 FROM HTTPS://WWW.ARTFIXDAILY.COM/ARTWIRE/RELEASE/7446-MARIANNE-BOESKY-GALLERY-TO-OPEN-EXHIBITION-OF-RECENT-WORK-BY-FRAN

ONUR YUCE GUN - BREATHE. IMAGES RETRIEVED 27TH JUNE 2021 FROM HTTPS://WWW.YOUTUBE.COM/WATCH?V=9KRYGSBDNMC

ZAHA HADID – EARLY PAINTING. IMAGES RETRIEVED 27TH JUNE 2021 FROM HTTPS://WWW.ZAHA-HADID.COM/2016/12/07/ZAHA-HADID-EARLY-PAINTINGS-AND-DRAWINGS/

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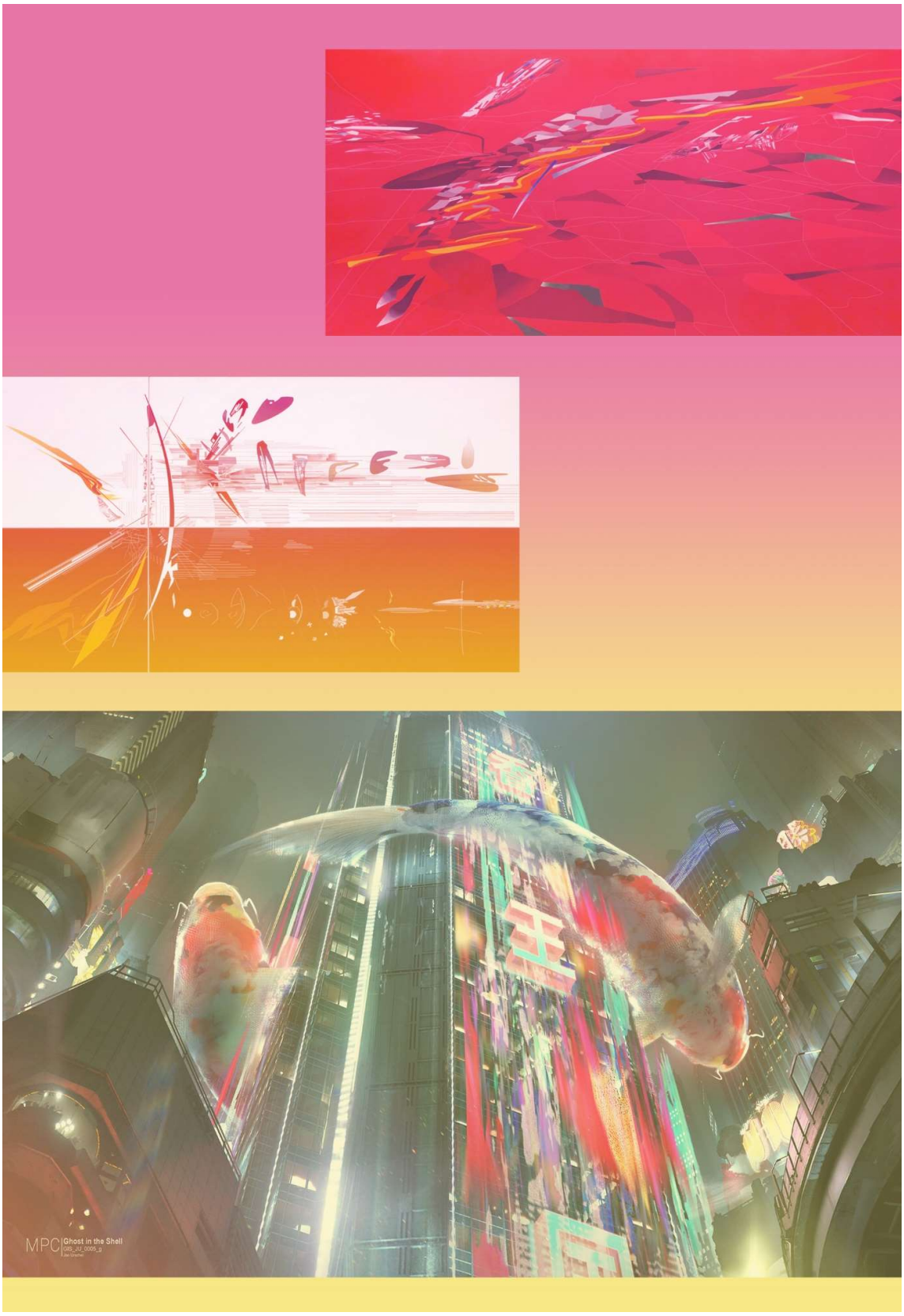
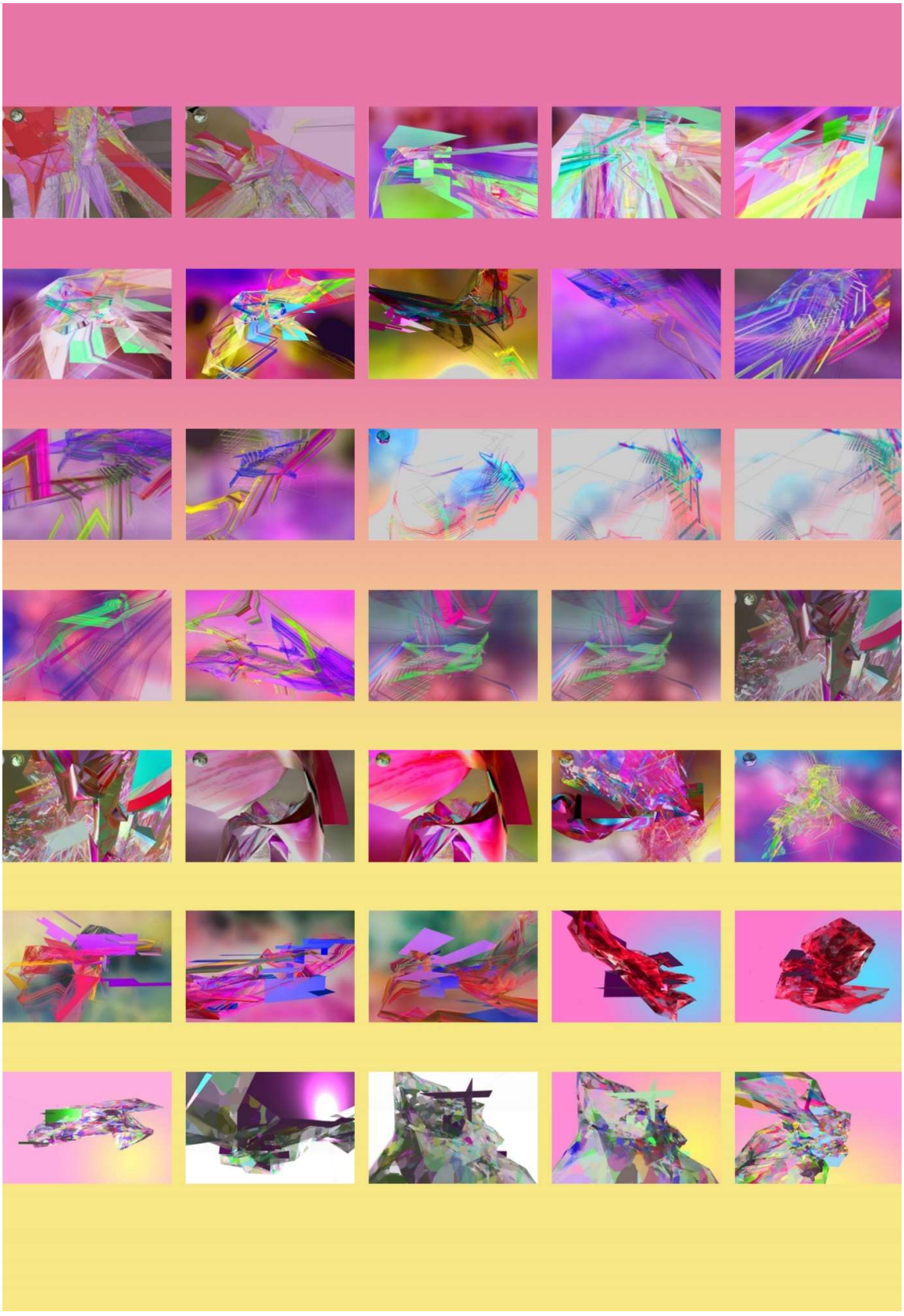
SNOHETTA. IMAGES RETRIEVED 27TH JUNE 2021 FROM HTTPS://SNOHETTA.COM/PROJECTS/10-JAMES-B-HUNT-JR-LIBRARY

REFIKA ANADOL STUDIO.IMAGES RETRIEVED 27TH JUNE 2021 FROM HTTPS://ART50.NET/EN/REFIK-ANADOL-MACHINE-MEMOIRS-SPACE/

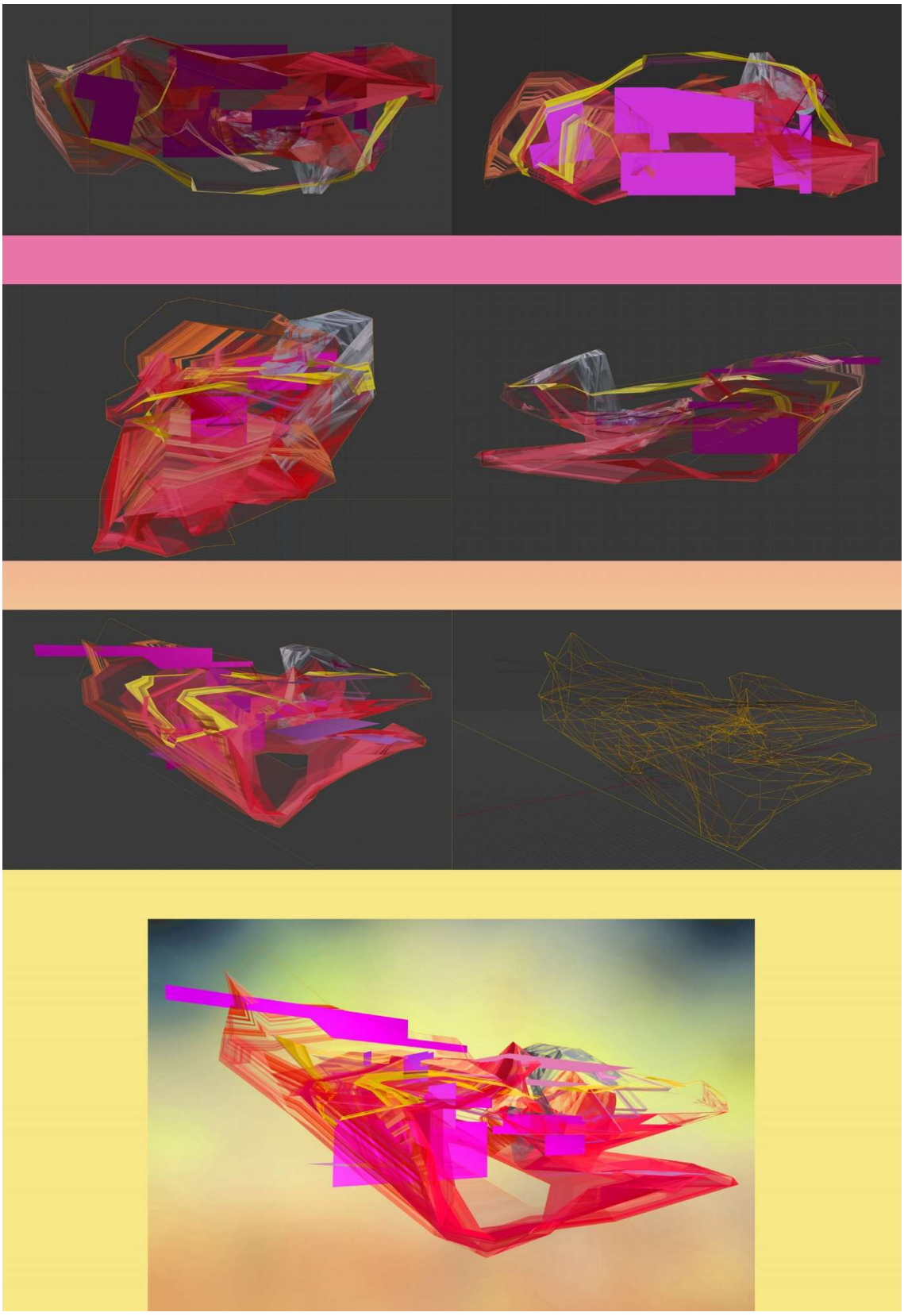
REFIKA ANADOL STUDIO. IMAGES RETRIEVED 27TH JUNE 2021 FROM HTTPS://WWW.ARTSTATION.COM/ARTWORK/OPR5K



ZAHA HADID - EARLY WORKS, PAINTIGS AND DRAWINGS IN SERPENTINE GALLERY 2017. FILM GHOST IN THE SHELL? FUTURE CITY WITH AR ELEMENTS.



MARKÉTA GEBRIAN STUDIES OF VR SHELL IN BLENDER, DEFORMED SPACE WITH TRANSPARENT TEXTURES AND COLOURS AND INSIDE WITH FLOATING LEVELS AND WALLS TO BE USED AS PRESENTATION SPOTS FOR SHOWING IMAGES AND VIDEOS, NEW TYPE OF VR CLASSES, JUNE 2021.



RENDERINGS BY MARKÉTA GEBRIAN –TOP VIEWS, FRONT, LEFT VIEWS, WIREFRAME PERSPECTIVES - IMAGES FROM BLENDER.

Dissertation Results, Original Research Contributions, Achievements, Improvements of Current Situation:

Designing the Metaverse:

I enjoy designing the metaverse. I work in the Neos VR metaverse. I created about 15 virtual worlds in Neos VR for free. Some of them are in the content Hub of Neos VR for avatars to inhabit. I think that the meta is another "strong" developmental phase that will permeate all spheres of life, work, and education. in connection with the world of "meta" I am trying to express my opinions and reasonably in depth show my work to imagine, what waits for us in near future like 10 to 15 years. ... We are experiencing the next historical stage of development of 3D internet and the next and new types of metaverse.

Conferences:

2021 EAB SYMPOSIUM / Experimental Architecture Biennial vol.5. My Presentation in Online EAB Symposium, 9th August 2021.

2020 Presented poster and presentation at the Ninth International Conference on Design Computing and Cognition DCC at the Georgia Institute of Technology, Atlanta, USA online.

2018 Presented paper at International Conference Generative Art 2018 in Verona, Italy.

2018 Presented paper at Design Computing Conference at CTU / MOLAB in Prague, Czech Republic.

2018 Presented poster and presentation in 8th International Conference on Design Computing and Cognition DCC in Milano / Lecco.

2017 Presented poster Gaudían Flowers over Barcelona / Architecture for Meetings in VR, at: eCAADe 2017 ShoCK! Sharing of Computable Knowledge, Rome: Sapienza Università di Roma).

2016 Architecture in Perspective conference in Ostrava, Article in the book of abstracts, Ostrava, Czech Republic.

Visiting Research:

2021 Fulbright Scholar at North Carolina State University in Raleigh, Department of Art and Design, College of Design, USA for six months.

2019 Visiting research at ISTAR-IUL, Information Sciences and Technologies and Architecture Research Centre in Lisbon, Portugal for 2 months.

2018 Visiting research at ETSAB - UPC Universitat Politècnica de Catalunya, in Barcelona, Spain for 3 months.

Solo Exhibitions:

2016 Compositional Archontextures / Fusion space, Prague, Czech Republic.

Group Exhibitions:

2021 EAB EXHIBITION. Experimental Architecture Biennial vol.5. My project: Fractal Paradise / Group Exhibition in Fragner Gallery, Prague.

2021 REQUIEM / VR EXHIBITION.
My 360 Video was presented during the Requiem 9/11 Event at Czech Center New York, USA, 9th, and 10th September 2021.
Author of the VR video: Ing. arch. Markéta Gebrian. Collaboration with Miroslav Konvalina, the director of Czech Center New York and Anna Kotyza, the director of Requiem.

2021 FULBRIGHT 75 VIRTUAL ART EXHIBIT
My Project was presented online together with other Fulbright Scholars from the whole world.

2020 Presented at the exhibition by ARTBOX.PROJECTS in Zürich, Switzerland.

2020 Presented at the exhibition by ARTBOX.PROJECTS Gallery in Barcelona, Spain.

2019 Presented at the Swiss Art Expo by ARTBOX.PROJECTS Gallery. Zürich, Switzerland.

2018 Design Computing Exhibition at CTU Prague, Czech Republic.

2018 Art for Peace in Neunburg vorm Wald, Germany.

2018 Presented at the ARTBOX.PROJECTS Gallery Switzerland during the week of The ARMORY ART WEEKS IN NEW YORK, New York, USA.

2017 Presented at the ARTBOX.PROJECTS 1.0 Exhibition in Basel during the week of ART BASEL, Basel Switzerland.

2016 FOX gallery, Prague 1, Czech Republic.

2015 ART PRAGUE 14th Contemporary Art Fair 2015 Prague 1, Czech Republic.

Grants:

2021 Fulbright Scholarship for 6 months, from American and Czech Government for visiting research at NC State University,USA.

2021 CTU grant SGS, student grant competition for 2021/2022 for my research of virtual reality spaces for education, FIS: 161 - 1612112E000.

2018 Grant from CTU to attend the 21st Generative Art Conference, Exhibition, Live Performances in Verona, Italy.

2018 Grant from Design Computing Cognition Conference 2018 to attend the DCC Conference in Lecco, Italy.

2016/17 Grant SGS/ Student Grant Competition from CTU to design Smart Structures in Virtual Reality together with a team from FLO|W, FIS: 161-1611608E000.

Winning Projects Awards:

2021 STANISLAV HANZEL AWARD.
I was awarded by CTU Foundation Stanislav Hanzel.

2018 THE FIRST PLACE in the competition of all Czech Universities organized by TAČR - CZECH TECHNOLOGICAL AGENCY PRAGUE. Called: "How Do You See It? Perspective/Czech Idea." How does art inspire technology? Team: Jindřich Ráftl, Markéta Gebrian and animators of the video.

2016 Inspireli Award 2016 / Semifinalist.

Artist Residency:

2018 Czech Center Moscow by Czech Embassy, topic: to deal with the artistic intervention in Czech House in Moscow.

Lectures:

2021 Architectural and Artistic Spaces Through Virtual Reality, Czech Center New York, NY, USA.

2021 NC State University in Raleigh, lecture for students of Department of Art and Design.

2019 ISTAR - Information Sciences and Technologies and Architecture Research Center, lecture for students about my Case study Barcelona.

2017 EnviroCity Festival: ''Floral Vegetable Fantasies'', Prague, Czech Republic.

2017 Pecha Kucha Night Zlín: ''My recent works'', Prague, Czech Republic.

2016 Lecture in Gallery ''U Bílého Jednorožce" Klatovy. Czech Republic.

2015 Pecha Night Night Znojmo: ''Art and Architecture and programming. '' Znojmo, Czech Republic.

2015 Pecha Kucha Night Ústí nad Labem: ''It is true in this moment." Ústí nad Labem, Czech Republic.

Future work:

I will collaborate with social VR platforms like NEOS VR and the Faculty of Information Technology. I will continue to develop my topic VR Architecture for social VR platforms. I will apply for grants in art, architecture, technology, and science. I will continue to design the metaverse in Neos VR.

Curriculum Vitae:

I, Markéta Gebrian am Prague–based digital artist, architect for virtual reality spaces in NEOS VR, a social VR platform. I started my studies in Architecture and Art at Technical University in Liberec in the Czech Republic. As an architectural intern, I worked in top architectural offices in Amsterdam, Rotterdam and Paris (Jean Nouvel Ateliers). I studied interior design at Rietveld Academy in Amsterdam with the Freemover Scholarship from the EU. I also studied architecture and urban planning at Ecole Val-de-Seine in Paris. I was awarded a scholarship from the Italian Government to research Borromini and Bernini art and architecture in Rome, I consulted my architectural research at La Sapienza University in Rome. I completed her master's degree in architecture in 2006 in Liberec. I worked as an Architectural Assistant Part II in London. As an architectural intern in Steven Ehrlich Architects in Los Angeles, I was in the winning team of the competition for UC Irvine Contemporary Arts Center in California. My dream was to start my new path in life and concentrate on art. In 2010 I created my first digital artwork using 3D programs I knew from the architectural practice. I have focused my attention on my digital work. I have exhibited as a solo artist in Prague and group exhibitions in 2020 Galegion/Utopian City in Centre for Contemporary Art DOX and Frágnerova Gallery Prague in Experimental Architecture Biennal in 2021. I had my group shows in Basel, New York, Zürich, Miami with the Swiss art gallery Artbox.Projects.
Since 2015 I have been PhD student at Czech Technical University in Prague, the topic of my dissertation is Architectural and Artistic Spaces Through Virtual Reality. I presented my work at architectural and art conferences: eCAADe in Rome, DCC Conference in Lecco/Milan, Design Computing Conference in Prague, Generative Art Conference in Verona and Markéta participated at the international conference Design Computing and Cognition with a focus on the application of programming and robotics with my poster and presentation about Interpretation of Lisbon into 3D model in virtual reality in NEOS VR in 2020.
I was awarded an artist residency in the Czech Centre in Moscow sponsored by the Czech Government. I successfully completed two types of visiting research, one was at Escola Tècnica Superior d'Arquitectura de Barcelona, ETSAB, where I interpreted Casa Mila by Gaudí and Eixample urban plan into a VR 3D model. The second research was in the ISTAR-Information Sciences and Technologies and Architecture Research Center, Iscte in Lisbon. I created the virtual world in NEOS VR as an interpretation of Elevador Santa da Justa and the surrounding area in Lisbon.
I have returned from the Fulbright Scholarship in the USA. She was excited to do my visiting research at the College of Design, Department of Art and Design at NC State in Raleigh in North Carolina. I worked under the supervision of Assistant Professor Derek Ham, PhD in Mixed Reality Lab http://www.mxrealitylab.com/. Department Head and Associate Professor of Art + Design at North Carolina State University, Derek Ham is: *"Experienced Design Educator with a demonstrated history of working in the higher education industry. Skilled in Analytical Skills, Virtual Reality Development, Computer Modeling & Animation, Design Research, Business Innovation, and Entrepreneurship. Strong education professional with a PhD focused on Design Computation from M.I.T."*

Annotation

My work explores possible approaches, possibilities how to design the VR Architecture, the 3D space in virtual reality in the metaverse. VR Architecture is a new concept that I introduced because it refers to architecture inhabited only in the metaverse, the online 3D Internet. The VR Architecture is not a visualization of a project that we can built in the physical world. The VR Architecture is not subject to the laws of gravity and statics like the structures in our real world. VR Architecture are architectural and artistic spaces that can be experienced through virtual reality in an online metaverse. Part of my dissertation are basic concepts, new terms. Then there is an overview of the history of computers, virtual reality, the introduction of the Neos VR metaverse, social network in virtual reality, the topic of avatars. I deal with virtual reality technology because it will soon be a topic that will move our lives from computer screens, mobile phones and tablets to the new interfaces, VR headsets, VR suits, etc. As can be seen, over the last year in 2021, many new metaverse were created. Projects where you can meet avatars online and work here, learn, play games, shop, or relax. In August 2021, Facebook announced that they were working on the development of a new META metaverse, which is the future of the 3D Internet in both virtual and augmented reality. It is estimated that it will take another ten to fifteen years for the use of metaverse to be fully expanded among users. I touch on the topic of elements of architecture in the physical world as well as elements of the VR architecture in the virtual environment, which define the space. I look for connections in the work of architects and artists who use computers for design and creation, then I focus on architectural projects dealing with utopias and fantasies. Utopias and fantasies of architects are easily realized in virtual reality in the metaverse. My goal is not to copy real architecture, cities, and environments in the physical world. I try to find ways to interpret existing places and create new connections in virtual reality in the metaverse.

In my dissertation I describe several projects, case studies, namely Magic Flower, Cocoon Flower in the City, Interpretation of Casa Mila in Barcelona into Artistic and Architectural Space for Virtual Reality, Interpretation of Elevador Santa da Justa into Artistic and Architectural Space for Virtual Reality Meetings. The first case studies are closer to artistic VR objects, they exist in the worlds of Neos VR. In the case study from Barcelona and Lisbon, I always focus on one building and its surroundings in both cities. I interpret and create new structures, VR Architecture for VR Worlds in the Neos VR metaverse. In the last part of my dissertation, you will find a project from my research at North Carolina State University, College of Design, Department of Art and Design in Raleigh, USA, where I was a Fulbright Scholar on a six-month. This project is different. I have mastered the procedures for designing VR Architecture. The method remains research by design, I focused on one building, the Hunt Library at NC State and it is also an interpretation of Hunt Library building. I was inspired by art, architecture, interior, light in the building, furniture, colours. I created test models in Blender and Rhinoceros. I thought about the possibility of interactive VR Architecture, because the Hunt Library has a section with robots that find books for library users. Visually, the result of this VR Architecture project is very abstract, there is also a difference from other case studies. VR Architecture here are VR Classes with educational functions. There are obvious elements of walls and floors because they define the space for VR classes, for online education in the metaverse.

At the end of my dissertation there are comparisons of current metaverse projects, these have often a game function or it is about casinos, shopping, also they have cryptocurrencies and money in the metaverse. Here it is good to realize that it is possible to buy not only game assets and NFT's, but also land, 3D spaces and houses in metaverse. It is now up to us architects and artists to design VR Architecture for the future 3D Internet, the metaverse. This work should point out the possibilities of cooperation between the IT community, programmers and architects, artists in creating a metaverse.

Anotace

Moje práce zkoumá možné přístupy, možnosti, jak navrhovat VR Architekturu, tj. 3D prostor ve virtuální realitě v metaverzi. VR Architektura je nový pojem, který jsem zavedla, protože se týká architektury pouze pro virtuální využití v metaverzi, online 3 D internetu. VR Architektura není vizualizace projektu, který se bude stavět ve fyzickém světě. VR Architektura nepodléhá zákonitostem gravitace a statiky jako konstrukce v našem reálném světě. VR Architektura jsou umělecké a architektonické prostory, které lze zažít prostřednictvím virtuální reality v online metaverzi. Součástí mé dizertace jsou uvedeny základní pojmy, nové termíny. Dále pak je zde přehled historie vzniku počítačů, virtuální reality, představení metaverse Neos VR, sociální sítě ve virtuální realitě, téma avatarů. Technologií počítačů se virtuální realitou se zabývám proto, že je to již v blízké budoucnosti téma, které posune náš život od obrazovek počítačů, mobilů a tabletů do nového rozhraní, a to používání VR headsetů, VR obleků apod. Jak je vidět, za poslední rok 2021 vzniklo mnoho nových metaversí, projektů, kde se online dá setkávat v tělech avatarů a pracovat zde, vzdělávat se, hrát hry, nakupovat nebo relaxovat. Firma Facebook v srpnu 2021 ohlásila, že pracují na vývoji nové metaverzi META, která je budoucností 3 D internetu ve virtuální realitě i rozšířené realitě. Odhaduje se, že bude trvat ještě deset až patnáct let, než se plně rozšíří používání metaverze mezi uživateli.
Dotýkám se tématu elementů architektury ve fyzickém tak i ve virtuálním prostředí, které vymezují prostor. Hledám souvislosti v práci architektů a umělců, kteří používají počítače pro navrhování a tvorbu dále se pak zaměřuji na architektonické projekty zabývající se utopií a fantaziemi. Utopie a fantazie architektů jsou snadno realizovatelné ve virtuální realitě v metaverzi. Mým cílem není kopírovat skutečnou, architekturu, města a prostředí ve fyzickém světě. Snažím se najít způsoby interpretace exitujících míst a vytvořit nové souvislosti ve virtuální realitě v metaverzi.
V mé disertační práci je popsáno několik projektů, případových studií, a to Magic Flower, Cocoon Flower in the City, Interpretation of Casa Mila in Barcelona into Artistic and Architectural Space for Virtual Reality, Interpretation of Elevador Santa da Justa into Artistic and Architectural Space for Virtual Reality Meetings. První případové studie jsou blízké spíše uměleckým VR objektům, existují ve světech Neos VR. V případové studii z Barcelony a z Lisabonu se věnuji vždy jedné budově a jejímu okolí ve městě, kterou interpretuji a vytvářím nové struktury, VR Architekturu pro VR světy v Neos VR metaverzi.
V poslední části mé disertace najdete projekt z vlastního výzkumu na North Carolina State University, College of Design, Department of Art and Design v Raleigh, USA, kde jsem byla jako Fulbright Scholar na šestiměsíční stáži. Tento projekt je jiný tím, že jsem si osvojila postupy, jak navrhovat VR Architekturu. Metoda zůstává research by design, zaměřila jsem se na jednu budovu, Hunt Library a jde také o interpretaci této budovy. Inspirovala jsem se uměním, architekturou, interiérem, světlem v budově, nábytkem, barvami. Tvořila jsem testovací modely v Blendru a Rhinoceru, přemýšlela jsem o možnosti interaktivní VR Architektury, protože Hunt Library má část s roboty, kteří podávají knihy uživatelům knihovny. Vizuálně je výsledek tohoto projektu VR Architektury velmi abstraktní, dále je zde odlišnost od ostatních případových studií, že jsou to VR Classes, VR třídy, mají edukativní funkce. Jsou zde patrné elementy stěn a podlah, protože vymezují prostor pro VR třídy, pro vzdělávání online v metaverzi.
V závěru mé disertace se objevují srovnání současných metaverzí, zde se jedná často o herní funkci metaverze nebo jde o kasina, nakupování a vůbec tématiku kryptoměn, peněž v metaverzích. Zde je dobré si uvědomit, že lze již dnes v metaverích kupovat nejen assety do her, ale i pozemky, 3D prostory a domy. Je teď na nás architektech a umělcích, jak budeme navrhovat VR Architekturu pro budoucí 3D internet, metaverzi. Tato práce by měla poukazovat na možnosti spolupráce mezi IT komunitou, programátory a architekty a umělci při tvorbě metaverze.