XRAYSCAPE

northern sky phenomena through extended reality

Denice Ivarsson | Master Thesis Spring 2023 | Examiner: Kengo Skorick | Supervisor: Jonas Lundberg | Chalmers School of Architecture | Department of Architecture and Civil Engineering

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CHALMERS

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Program: Architecture and Urban Design
Direction: Material Turn
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ABSTRACT

Northern sky phenomena, such as northern lights, midnight sun and polar night, attract people from all around the globe. For the local population on the other hand, the never-ending nights during winter and never-ending days during summer can entail negative effects, repelling people.

Extended reality, XR, is a versatile technology that can be applied to enhance or represent different activities ranging from entertainment to professional. XR has entered exhibition contexts for improved way-finding, additional information and exhibited material. Recent studies also indicate that XR could provide potential rehabilitation methods for different types of depression.

This thesis explores the combination of XR as an exhibition technology and antidepressant. The display of various northern sky phenomena aims to offer complementing experiences to the visitor, whether it is a traveller coming for the northern lights but who is also intrigued by the midnight sun, or a resident who wishes to escape the darkness that causes their seasonal affective disorder.

The site chosen for the exhibition is the decommissioned mine Tuolluvaara in Kiruna, Sweden. Kiruna has a conflicted history and relationship with nature due to its extensive iron ore mining activity. Kiruna is also the municipality in Sweden where the highest number of Sámi people live. The mine has heavily inflicted and continues to do so on land that has historically been used for reindeer herding. The mining industry and Sámi represent two extreme versions of what it means to live of what nature has to offer. The mine financially supports a whole nation and is essential for the city of Kiruna that we know today, but has serious consequences for nature, its wildlife, people and architecture of Kiruna.

Sámi tourism today struggles with what image to share, tourists often expect a traditional or stereotypical Sámi culture. Reindeer herding nowadays is carried out with electric vehicles and economically supports a reducing number of Sámi people. Maintaining an outdated image risks to ‘disneyficate’ the culture. Reclaiming the abandoned mine and filling it with natural wonders under Sámi direction could contribute to a more versatile impression of Sámi culture and reconciliation.

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RESEARCH QUESTIONS

I Could XR contribute to a richer experience of natural wonders when visiting the north?

II Could XR offer alleviation to people suffering from seasonal affective disorder?

III Could XR help broaden the image of Sámi culture?

DELIMITATIONS

This thesis explores the technology of augmented or mixed reality where digital overlays are added to enhance and interact with a physical space.

In absence of this physical space, however, the design of this thesis will be represented with the technology of virtual reality, where all elements are digital.

The most frequently used term through this thesis is extended reality, since it encompasses all three technologies.

AIM & BACKGROUND

The initial aim for this thesis was to explore extended reality, XR, as a method to help people in the northern parts of Sweden suffering from seasonal affective disorder, SAD. XR provides us with the opportunity to create digital 3D spaces with qualities that our physical space is lacking. Thus, in winter time during polar night, XR allows us to escape the darkness by entering into a bright space with a clear blue sky. Same goes for the opposite phenomena midnight sun during summer time, where one can turn to XR for a starry night sky.

While performing early research on SAD, polar night and midnight sun, fascination started to grow for northern sky phenomena. People travel long distances to experience them, but unless the trip lasts for several months, it is not possible to see them all. This is how the idea of walking from under one sky to another within minutes started to form and the target group grew to include people wanting to learn more about northern light phenomena.

The site chosen for the project is the abandoned mine Tuolluvaara, in the city of Kiruna, part of the largest municipality in Sweden with its 19 447 km^2 (Kiruna Kommun, 2023). Its location north of the polar circle and beautiful landscape make it a magnet for people seeking an adventure and connection with nature.

Beneath the striking city silhouette, lays valuable metals and minerals important for Swedish economy. State owned mining company LKAB extract iron ore corresponding 13 Eiffel Towers every day (LKAB, 2023). The expansion of the mining industry has been inflicting on land that has historically been used for reindeer herding by indigenous Sámi people (Sametinget, 2021). The expansion has also caused severe local geological instabilities, leading to a relocation of the Kiruna city centre (Liljebäck, 2019).

A rather straightforward concept applied to a complex context raises many questions and potential conflicts. Modern and advanced XR technology meets the old, decommissioned mine Tuolluvaara. Artificial natural wonders meet destruction of nature. Light meets darkness.

METHOD

I Studying XR technologies

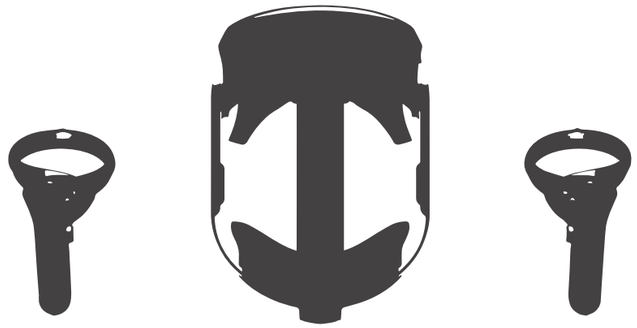
Reading about virtual, augmented and mixed reality and studying how these can be used in the treatment of different types of depression. Finding and evaluating relevant reference exhibition projects utilizing varying XR technologies. Learning how to set up, connect and use the VR headset and design for VR in Unreal Engine and other softwares.

II Deciphering a complex context

Going on a study trip to Kiruna, Abisko and Jukkasjärvi. Observing the landscape and northern lights. Meeting with the municipality and LKAB. Learning about the mine, Sámi culture / architecture / tourism, seasonal affective disorder and relocation of the city centre. Reading about different northern sky phenomena.

III Bridging the two through the design of an XR exhibition

Modelling an exhibition space and filling it with light and local content, creating materials based on textures from real photographs, designing Sámi inspired pavilions, animating northern lights and illustrating skies.



TOOLS

Hardware

VR headset HTC VIVE FOCUS 3 with hand controllers

Screen:	Dual 2.88″ LCD panels
Resolution:	2448 x 2448 pixels per eye, 5K
Field of view:	Up to 120 degrees
Refresh Rate:	90 Hz
Sensors:	4x Tracking cameras, G-sensor, Gyroscope, Proximity sensor
Tracking:	VIVE Inside-out Tracking
Processor:	Qualcomm® Snapdragon™ XR2
Storage & RAM:	128 GB / 8 GB

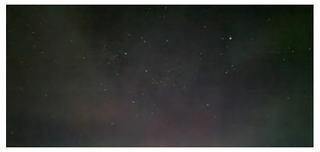
DELL XPS 15

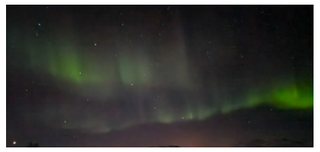
Processor:	Intel(R) Core(TM) i7-7700HQ CPU @ 2.80GHz 2.80 GHz
RAM:	16.0 GB
System type:	64-bit operating system, x64-based processor
Graphics:	NVIDIA GeForce GTX 1050

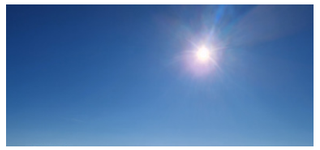
Software

Rhino 3D & Grasshopper:	Parametric and nurbs modelling
Cinema 4D:	Visualization & animation
Unreal Engine 4 & Blueprint:	VR
Vive Business Streaming:	Connecting headset to PC & UE
STEAM VR:	Connecting headset to PC & UE
Adobe After Effects:	Animation of northern lights
Adobe CS:	Post production

THEORY







MIDNATTSSOL

Midnight sun occurs when the sun never sinks below the horizon during the night (Jones, 2019).

POLARNATT

Polar night occurs when the sun never rises above the horizon during the day (Burn, 1996).

STJÄRNHIMMEL

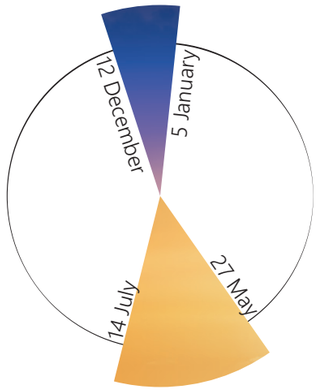
A starry night occurs in the absence of the sun, clouds and light pollution.

NORRSKEN

Aurora borealis or northern lights occur when charged particles (usually electrons) from the sun hits the outer parts of the earth's atmosphere close to the north pole (SMHI, 2022).

KLARBLÅ HIMMEL

A clear blue sky occurs in the presence of the sun and absence of clouds and light pollution.



SAD

Seasonal Affective Disorder, SAD, which also goes under the name seasonal depression, is a mental health problem that is recurring for a person at a specific season annually. It is estimated that up to one out of five recurrent cases of depression have a seasonal pattern. The most common situation is a depressed state linked to a period during the dark winter, but some people suffer from SAD during summer (Roecklein & Rohan, 2005).

SAD seems to have a higher prevalence among populations living closer to the north or south pole compared to people living near the equator (Mayo Clinic, 2021). Since SAD is connected to longer periods with less or more presence of daylight (Pattyn et al., 2018), one can imagine that a bigger contrast between seasons would mean a higher risk of SAD. Epidemiological studies performed in the US show that 1.4 percent of the adult population suffer from SAD in Florida while the corresponding number is as high as 9.7 percent in the more northern located New Hampshire (Friedman, 2007).

Known symptoms to SAD during winter are excessive sleeping and eating, weight gain and increased tiredness. People suffering from SAD during spring and/or summer often have symptoms such as insomnia, poor appetite, weight loss and anxiety (Mayo Clinic, 2021).

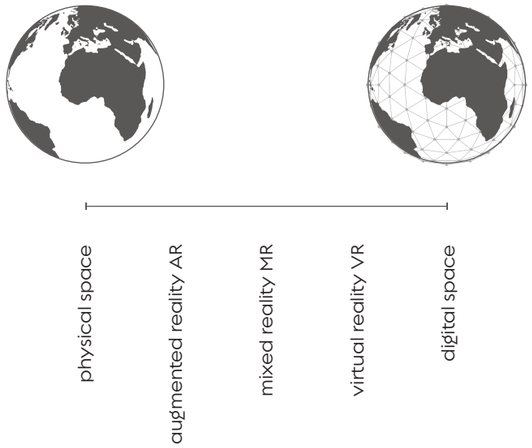
The most successful treatments of SAD available today are light therapy (Roecklein & Rohan, 2005), physical activity (Drew et al., 2021) and medication, many sources also include going on a sunny vacation as a way to reduce the risk of SAD (Friedman, 2007).

Light therapy can be given in different forms, a study tested two methods; one group spent six hours in a brightly illuminated room in their home, and one group spent 30 minutes in front of a light box of 10,000 lux. The results from the study were successful for both test groups. For the lightbox group it was indicated that a lighter illuminance gave an improved effect on symptoms (Sandkühler et al., 2022).

VR AS POTENTIAL ANTIDEPRESSANT

Looking into VR as a potential alternative to treat SAD, no studies have yet been performed with SAD patients, but with patients suffering from many other forms of depression. A study gathering and reviewing all previous studies on the subject concludes that VR seem to be effective in supporting the treatment of anxiety or depression (Baghaei et al., 2021).

Three more recent studies have investigated VR as a potential rehabilitation method for people suffering from depression caused by isolation (Fan et al., 2022), post-covid (Rutkowski et al., 2022) and post-stroke (Wang et. al., 2022). All three studies indicate that VR has the same or even better effects than traditional rehabilitation and training programs used for the control groups.



XR

Extended reality is an umbrella term for all technologies below (Tremosa, 2022). VR is XR but not all XR is VR.

VR

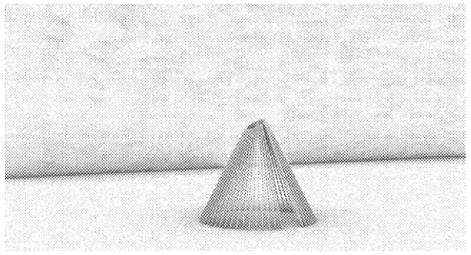
Virtual reality completely blocks out the physical world visually and the user sees a world that is constructed with digital elements only, not possible to collide with physically (Microsoft, 2023).

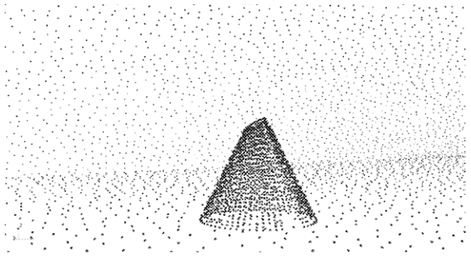
AR

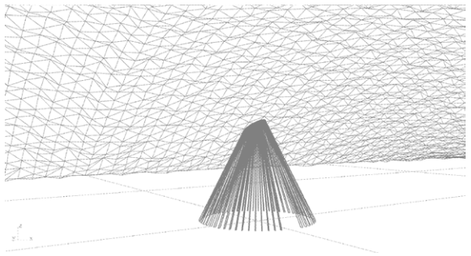
Augmented reality is adding digital overlays to our physical world. These layers are not interactive (Tremosa, 2022).

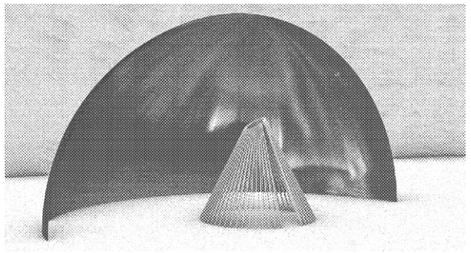
MR

Mixed reality also adds digital overlays to our physical world, but unlike AR, MR allow us to interact with objects part of the digital world (Tremosa, 2022). A digital representation of an object that you can take apart, scale the components of and then reassemble is an example of MR.









MARKER BASED XR

First, marker-less XR allows the user to display digital material independently of the environment, it is placed out based on the geometry of the physical space. A 3D object that is designed to sit on a surface can be placed out on the floor or on any tabletop (Aircards, 2021).

Marker based XR is placing digital elements at specific locations and with a set orientation in space. When a marker is recognized a digital object appear adjacent to the marker, as if the marker is the point of origin from where the object emerges (Aircards, 2021).

Types of markers:

- QR codes (2D)
- Images (2D)
- Objects (3D)
- Spaces (3D)

OBJECT RECOGNITION

For marker-less or marker based XR, object recognition technologies are used to match and line up the digital material with our physical space.

- Hardware such as a phone, headset or scanner gathers information such as photos or scans
- Software analyzes contrasts between pixels of an image or measured distances of a scan, feature points are recognized that correspond to reference material
- These feature points create a network of points or point cloud
- A triangulated mesh is generated from the point cloud and a digital representation of the object is created
- Digital material can be designed and will be placed accordingly to the identified feature points

(Larsson & Norén, 2019)

SPATIAL XR

Spatial XR utilizes a physical space as a marker. A whole space is scanned and represented as a 3D model to which it is possible to add digital material. These overlays automatically get their right placements in the physical space as soon as it is recognized by the hardware.

(ECO)TOURISM IN SCANDINAVIA

Ecotourism can be defined as tourism that is kind from an environmental and social perspective, since it contributes to local economies and the conservation of protected areas. Another important aspect of ecotourism is that it educates the traveller about local nature and culture. In Scandinavia, ecotourism accounts for a large portion of all tourism and an substantial source of income (Gossling & Hultman, 2006).

The top two natural wonders in Sweden are northern lights and the midnight sun according to Visit Sweden (2022). These phenomena occur at different times of the year, making it impossible to experience them both on one regular trip. An XR exhibition where one can get a feeling of multiple sky phenomena in just one visit would enrich the experience. It is a stretch to say that the exhibition itself would qualify as ecotourism, but with its educative nature, the two would reinforce one another.

SÁMI TOURISM IN SWEDISH LAPLAND

With reindeer herding economically supporting a smaller number of the Sámi population, the importance of Sámi tourism increases. Sámi tourism today struggles with what image to share, since tourists often expect a traditional or stereotypical Sámi culture.

When looking into the three aspects of sustainability, some of the negative social impacts that indigenous tourism have on the Sámi population are alienation, commoditization and ‘disneyfication’ of the culture and people. Negative environmental impacts are littering, erosion and noise. A negative economical impact is the irregular income that comes with seasonal jobs (Gossling & Hultman, 2006).

KIRUNA

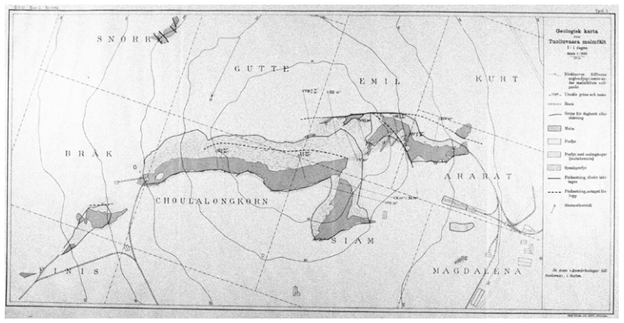
23 000 people live in Kiruna (Kiruna Kommun, 2022) and it is the largest municipality in Sweden with its 19 447 km^2 (Kiruna Kommun, 2023). Kiruna is the municipality with the highest number of Sami people in Sweden (Sveriges Radio, 2013).

LKAB is a mining company owned by the Swedish state. 17.3 % of the residents in Kiruna are employed by LKAB, making it the second biggest employer after the municipality (Regionsfakta, 2022).

CITY RELOCATION

Expansion of the mine Kiirunavaara is causing serious geological instabilities under the old city centre, and in 2004 the municipality announced the relocation that is planned to go on until 2035 (LKAB, 2022). Some buildings and building elements are being moved to the new centre, but many will be demolished and lost in the process (Kiruna Kommun, 2022).

WHITE and Ghilardi + Hellsten are responsible architects.



LTU, 2022

TUOLLUVAARA

The site for this project is the decommissioned mine Tuolluvaara which can be accessed through the cylindrical headframe.

Before the mining activity started, the area was used for reindeer herding by Gabna sameby and farmers from Jukkasjärvi cultivated the surrounding fields. (JAMTLI, 2019).

The mining of iron ore started in 1903 by Tuolluvaara Gruv AB and proceeded until 1982 when the mine was closed due to low profitability (Tuolluvaara Gruv AB, 2020). During its last years the company was bought by Luossavaara-Kiirunavaara Aktiebolag, LKAB.

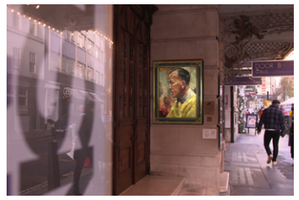
Six substantially large iron ore volumes were found and extracted, around 70 m below the top of the mountain. The biggest, named Chulalongkorn was 150 m long and 30 m wide. The others were named Emil, Siam, Bråk, Bak and Kurt (JAMTLI, 2019).

The drawing illustrates the positions of the different volumes in the mountain and how they are connected by less dense iron ore masses. The large central area is used for the exhibition space in the design project.

Close to the mine the residential area Tuolluvaara can be found. Entry points for skiing, hiking or going by scooter are easy to access from here (Kirunabostäder, 2023).

EXHIBITION REFERENCES

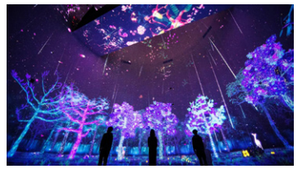
Playlines, 2021



Art of London, 2021

Art of London, 2021

teamLab, 2016



teamLab, 2016

teamLab, 2016

Muséum national d'Histoire naturelle, 2021

Muséum national d'Histoire naturelle, 2021

Muséum national d'Histoire naturelle, 2021

ART OF LONDON

National Gallery

London

Technology: AR through smartphones and QR codes

STORY OF THE FOREST

National Museum of Singapore

Singapore

Technology: Interactive projection, LED screens, AR through smartphones

REVIVRE

Muséum national d'Histoire naturelle

Paris

Technology: AR through Microsoft Hololens

SAMI ARCHITECTURE REFERENCES






















KLYKSTÅNGSKÅTA / LAVVU

Circular floor plan.

Can easily be relocated, wind resistant. The use is mainly limited to reindeer herding nowadays.

Three straight poles with forks form the base tripod structure that support additional straight poles. The lavvu can be covered by hides, canvas, peat or timber (Ruong, 1982).

BÅGSTÅNGSKÅTA / GOATHI

Oval floor plan.

Can easily be relocated. The use is mainly limited to reindeer herding nowadays.

Two pairs of curved poles are connected by one straight and horizontal center pole. Two more horizontal poles are attached to the sides to support the additional vertical straight rods. The goathi can be covered by hides, canvas, peat or timber (Ruong, 1982).

TORVKÅTA / LAVDJNEGOATHI

Circular or oval floor plan.

For permanent use, improved thermal conditions.

The base structure can either consist of a lavvu or goathi. It is covered by peat that with time can get overgrown with grass or moss (Ruong, 1982).

STOLPBOD / NJALLA

Rectangular floor plan.

A traditional rectangular building volume with gable roof raised on a pole for food storage prevented from animals. A more robust material use of timber. A ladder is used to access the space and is then removed (Ruong, 1982).

TIMMERKÅTA

Rectangular, hexagonal or octagonal floor plan.

For permanent and often public use, it often provides larger spaces than the other typologies.

In many cases it has a vertical base structure and an inclined top. A more robust material use of timber (Ruong, 1982).

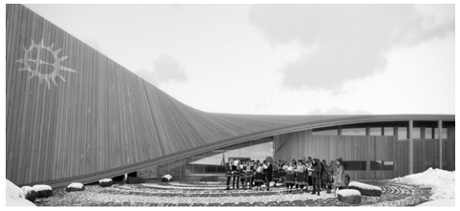
STUGA

Rectangular floor plan.

For permanent use, common today as residential buildings.

Murman, 2005

Niliaitta, 2019



Snøhetta, 2020

Stein Halvorsen, 2004

Murman, 2018

Lapland North, 2012

Murman, 2015

Stein Halvorsen, 2000

ArchDaily, 2011

Reform Travel, 2018

SAMETINGET / Murman

NILIAITTA / Studio Puisto

ČOARVEMÁTTA / Snøhetta

TANA TINGRETT / Stein Halvorsen AS

IDRE SAPMI LODGE / Murman

SAJOS / HALO

LÁDDJUJÁVRI / Murman

SAMETINGET / Stein Halvorsen AS

SAIVU / Eriksen Skajaa & Pushak

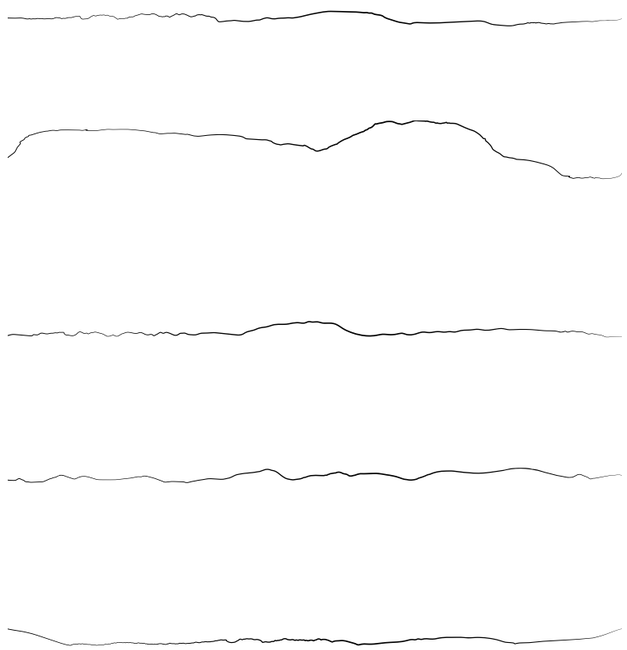
SAPMI NATURE CAMP / Lennart Pittja

STUDY TRIP

26 MARS – 2 APRIL

NORTHERN LIGHTS

Experiencing and photographing the natural wonder from Björkliden with high ISO and slow shutter speed.



LANDSCAPE SILHOUETTES

Getting familiar with the curved shapes of surrounding mountains by collecting silhouettes from Njulla, Trollsjön, Torneträsk, Vuolep Njakajaure in Abisko and Luossavaara in Kiruna.

MEETING WITH THE MUNICIPALITY

Discussing the vision of the new city centre and its close connection to the decommissioned Tuolluvaara mine.

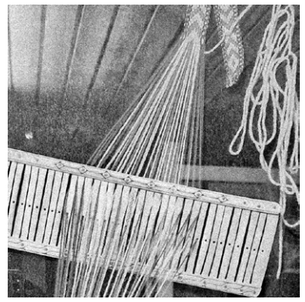
The two characteristic headframes that still stand on top of the abandoned shaft are planned to be conserved by Kiruna municipality and LKAB (Kiwa, 2019). The adjacent surrounding area will most likely be sparsely exploited due to potentially unstable ground conditions.

Some of the reasons behind keeping the headframes for future purposes are the following (Kiruna Kommun, 2023):

- They are important landmarks
- They are located right next to the new city centre
- They will be the backdrop to the new green passage
- With an extensive addition of new buildings it is highly important to keep the existing
- Their characteristics reflect the history of the area
- The cultural heritage is of national interest
- They contribute to the new city silhouette and variation in building typologies

Many ideas of what to use the towers for in the future have been presented such as bungee jumping, climbing, graffiti art, solar energy and light design. Housing and hotels have also been up for discussion but would require massive alterations for their appearances and façades.

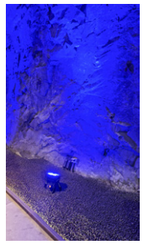
Exploring the site of the mine, its headframes and surroundings multiple times to document and understand the distance and connection to the new city centre.



SÁMI CULTURE

Visiting Samegården Museum in Kiruna and the open-air museum Nutti Sámi Siida in Jukkasjärvi to learn more about Sámi architecture, handicraft and reindeer herding.

The many different patterns of weaving and knitting have been an important source of inspiration when designing the pavilions for the exhibition.



LKAB:S VISITOR CENTRE

Visiting the exhibition located 540 m underground in the iron ore mine Kiirunavaara to learn about what systems are used for electricity, lighting and ventilation.

It is a very straightforward process where they simply extend the wiring, piping and tubes continuously the further into the mountain they get. Installations are attached to the walls and roof by drills and bolts. Some cables and installations are concealed by gravel close to the walls.

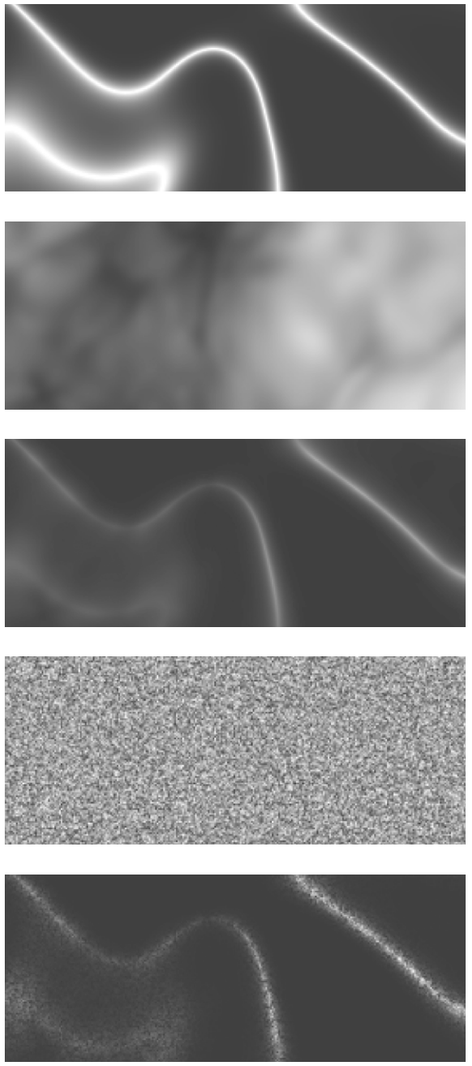
In some parts, where the rock is too porous a thin layer of shotcrete is added to prevent stones and dust from falling down.

When artificially lighting an underground space, one can take advantage of using light sources with varying temperatures and colours. Led tubes are the most frequently used light sources in the mine but for the exhibition point lights and spot lights create a more dynamic atmosphere.

ICE HOTEL

Visiting the Ice Hotel in Jukkasjärvi to get inspiration for the pavilions and lighting of the XR exhibition. The massiveness and solidity of the packed snow and ice is reminiscent of mine spaces. Point lights and spotlights with concealed wiring are used together with natural light.

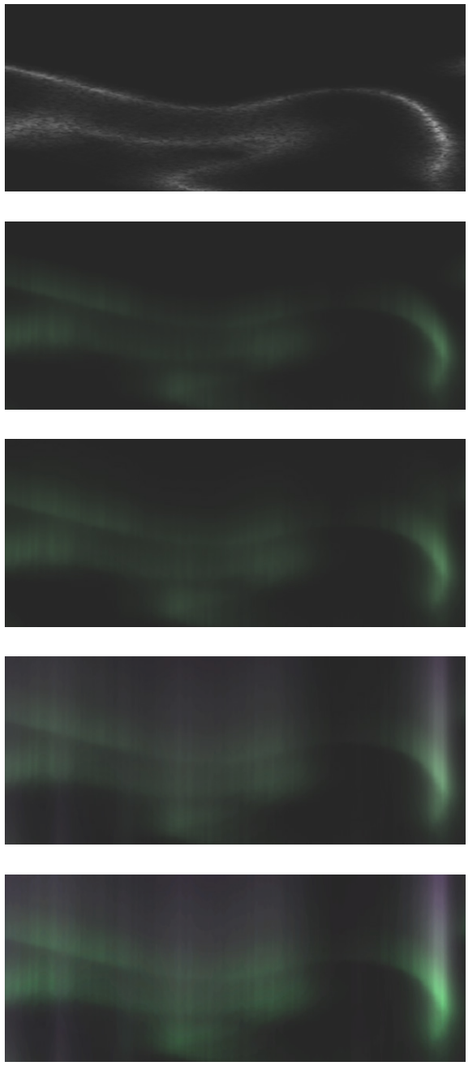
DESIGN



ANIMATING NORTHERN LIGHTS

1. Noise layering

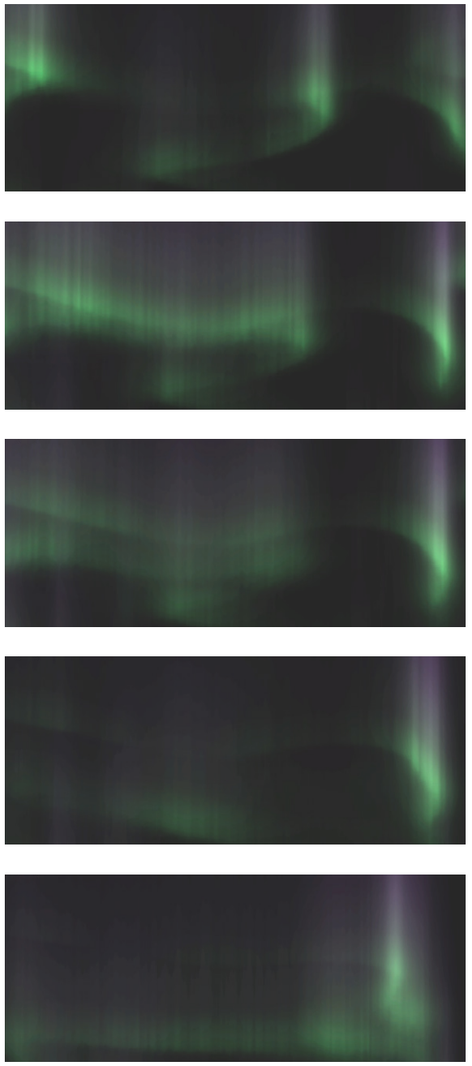
- The first layer gives the base lines for the northern lights
- The second layer masks the base lines so that they get realistically interrupted and irregular
- The third layer is a finely grained noise that adds the effect of tiny individual strikes that together form the northern lights



ANIMATING NORTHERN LIGHTS

2. Tilting & blurring

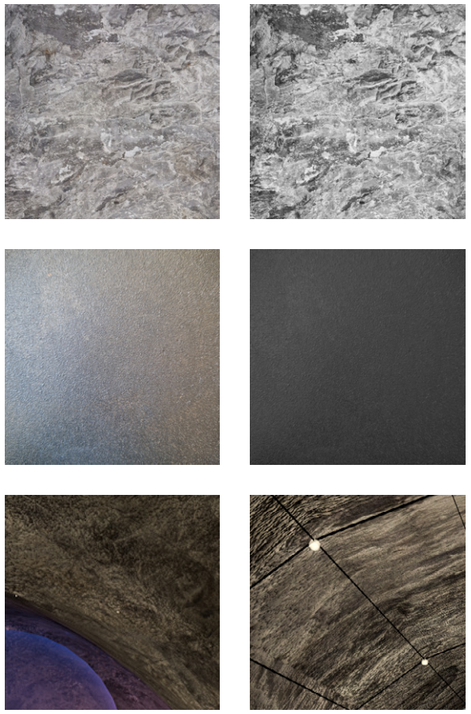
- Converting the 2D material to 3D and tilting it for depth of field
- Several vertical blurs are added with different colour tints in green, blue and purple



ANIMATING NORTHERN LIGHTS

3. Animation

- The two first noise layers get a slower pace for the overall dancing expression
- The third gets a faster pace for the individual strikes to move quickly and independently



TEXTURES OF THE MINE

Rocky surface from the mine Kiirunavaara.

Cast iron.

The black and white images are used as bump and reflection maps.

LIGHTS OF THE MINE

Hundreds of LED bulbs are connected to the 5 x 5 m^2 cable grid attached to the mine walls and ceiling. The color tint and temperature of the bulbs are adapted to the skies to enhance their expressions.

Old city centre

New city centre

Tuolluvaara

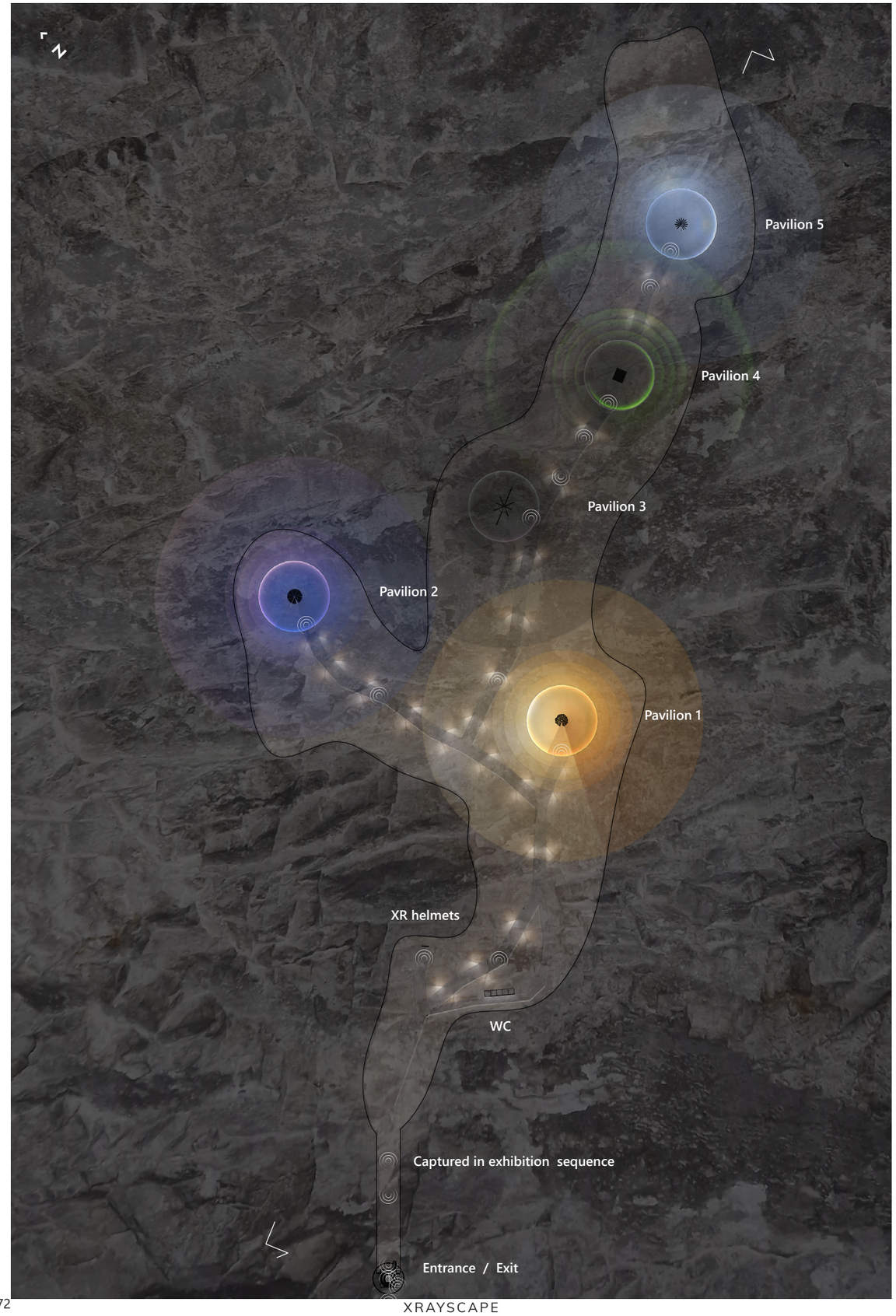
Green passage

New city centre

Tuolluvaara

N >

1:5 000

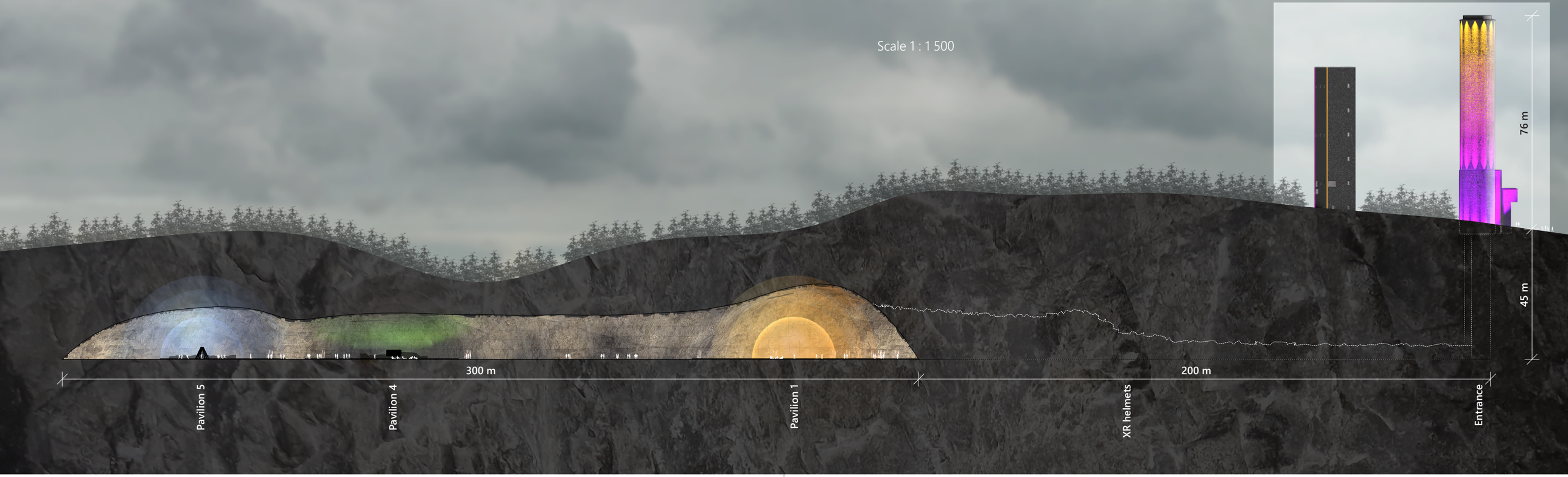


PLAN OVERVIEW

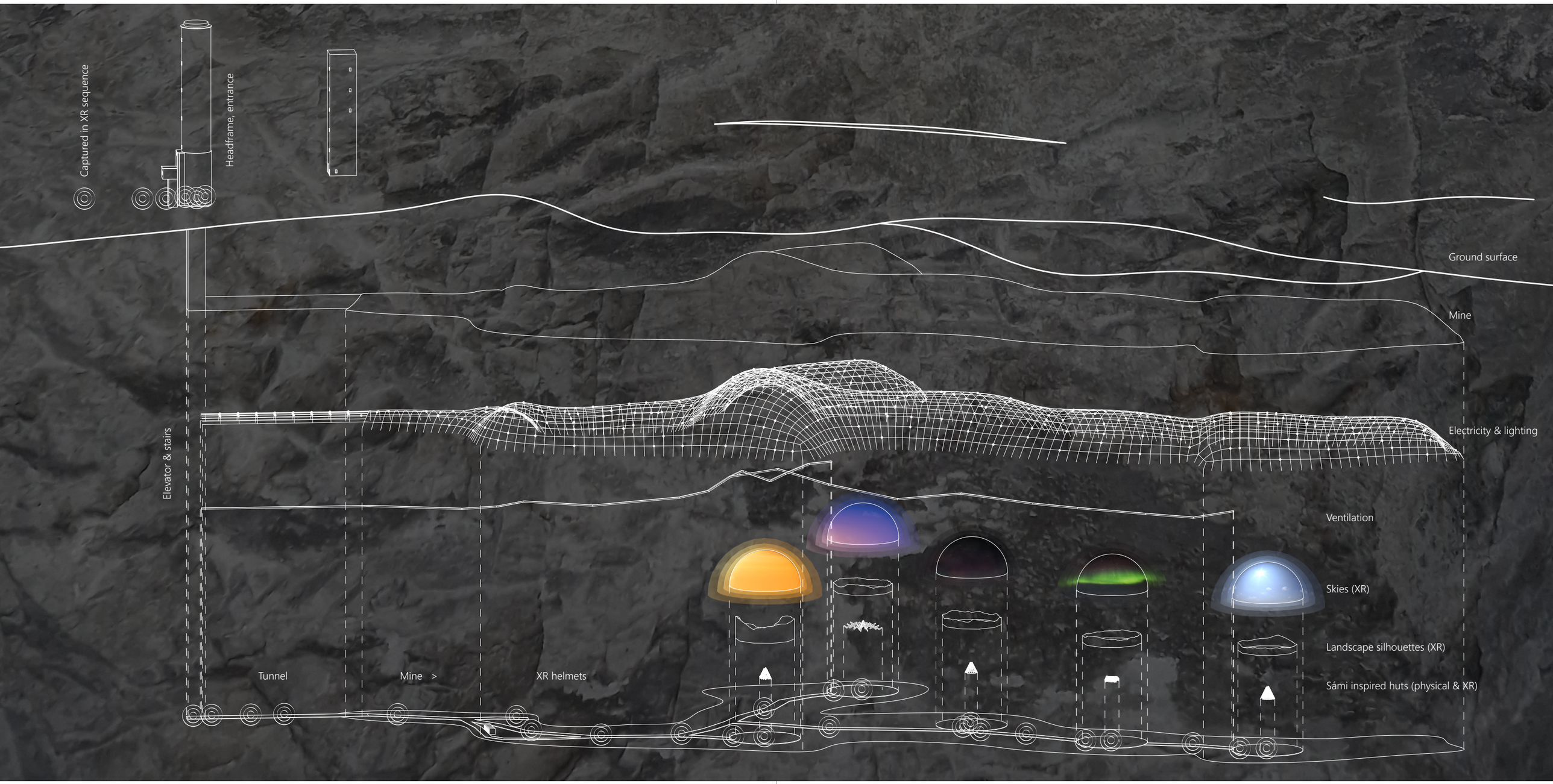
Scale 1 : 2 000

SECTION OVERVIEW

Scale 1 : 1 500



EXPLODED AXO



EXHIBITION SEQUENCE

Entrance through the cylindrical headframe

The light design gives away a bit of what is to come

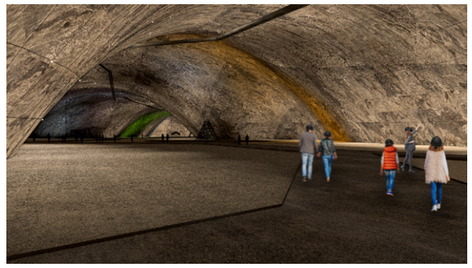
Purchase of tickets

The elevator or staircase take visitors 45 m underground

A tunnel connects the headframe with the mine

A tunnel connects the headframe with the mine

Helmets with built in XR headsets



The first glimpse of the mine without a headset on

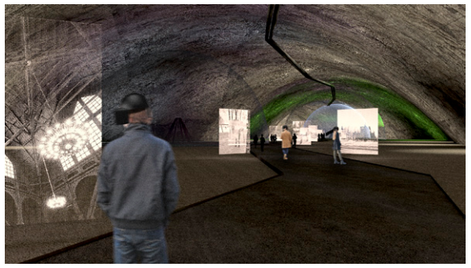
The first glimpse of the mine with a headset on

The Midnight Sun pavilion, here during a smaller concert

EXHIBITION SEQUENCE

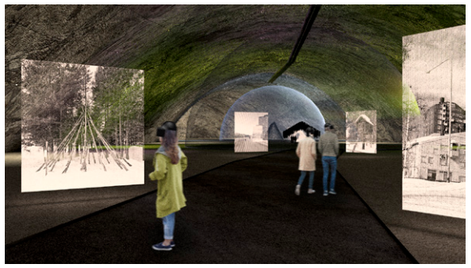
Photographs of traditional Sámi elements

The Polar Night pavilion, here during a yoga session

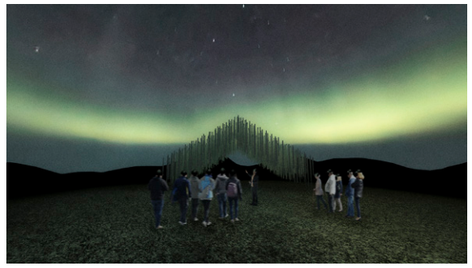


Photograph of the interior of the church which will be moved

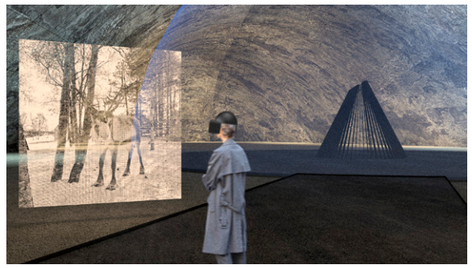
The Starry Sky pavilion, here with resting people



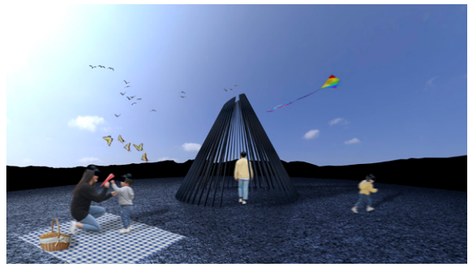
Photographs of Sámi architecture



The Northern Lights pavilion, here during a guided tour



A photograph of a reindeer



The Clear Blue Sky pavilion, here with playing children

Photographs of the old Kiruna city centre

Reaching the exit and end of the tour

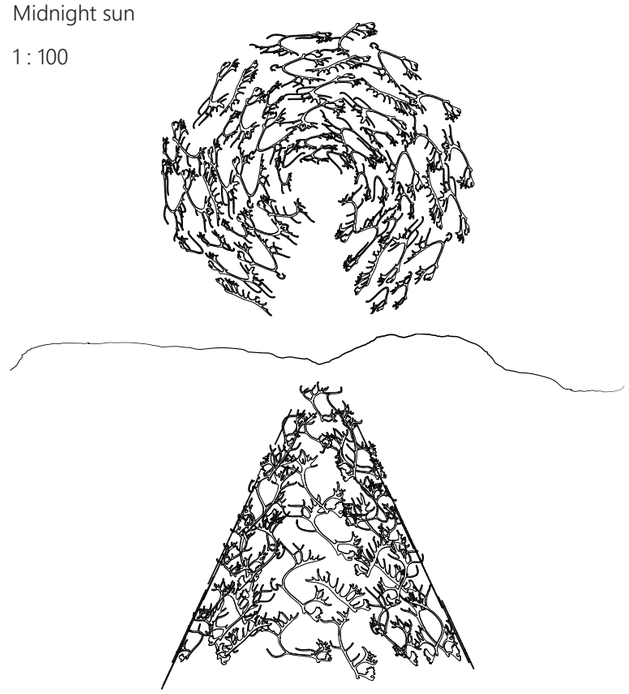
PAVILION NO 1 | MIDNATTSSOL

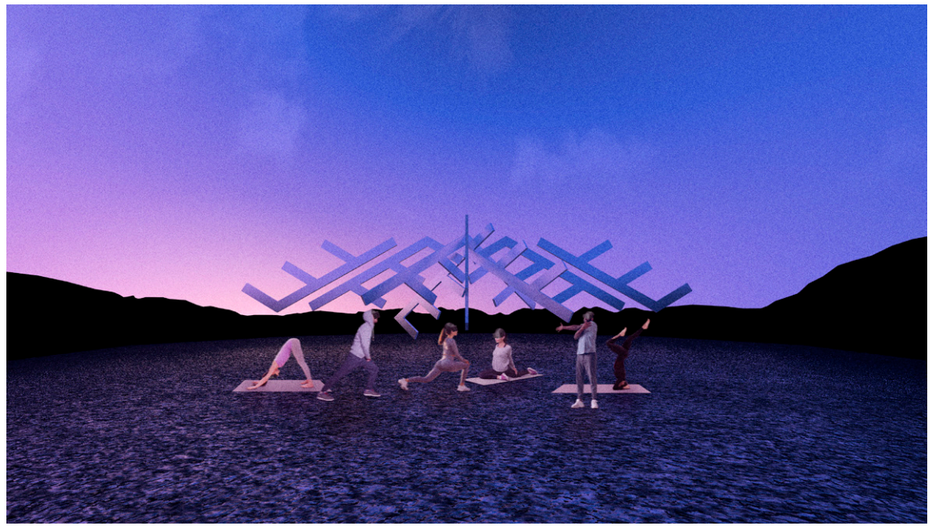
Inspiration: Lavvu and reindeers

Landscape: Trollsjön

Sky: Midnight sun

Drawing scale: 1 : 100





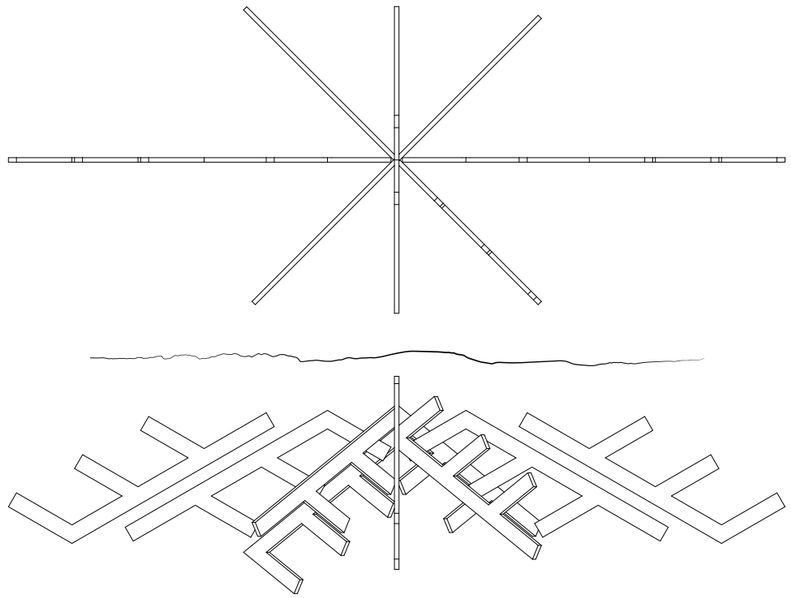
PAVILION NO 2 | POLARNATT

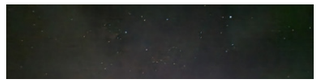
Inspiration: Goathi and duodji

Landscape: Torneträsk

Sky: Polar night

Drawing scale: 1 : 100





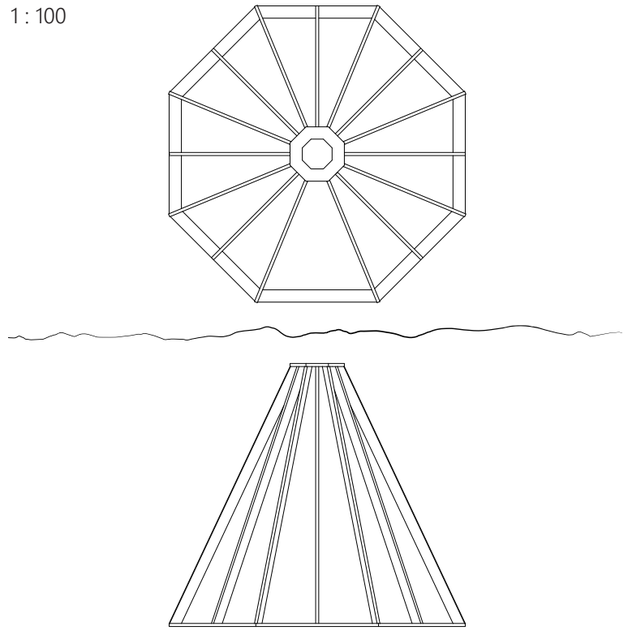
PAVILION NO 3 | STJÄRNHIMMEL

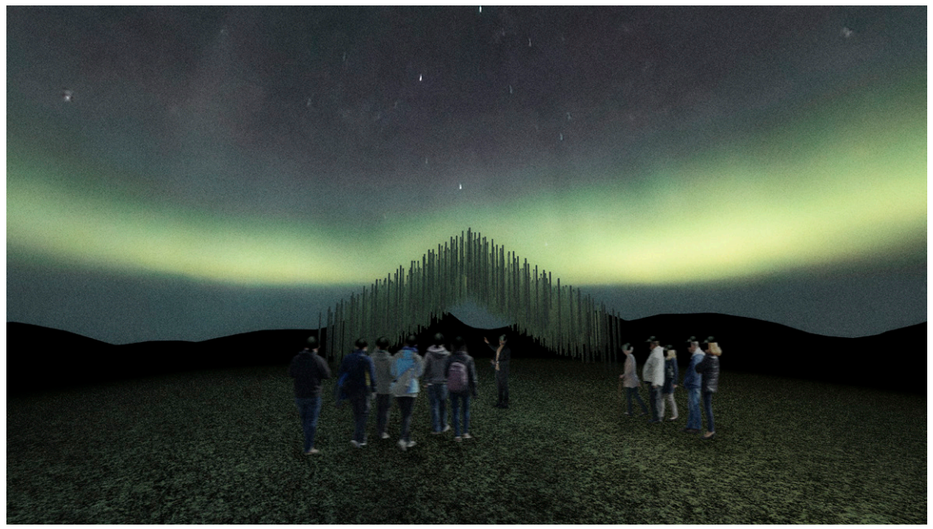
Inspiration: Lavvu

Landscape: Vuolep Njakajaure

Sky: Starry night

Drawing scale: 1 : 100





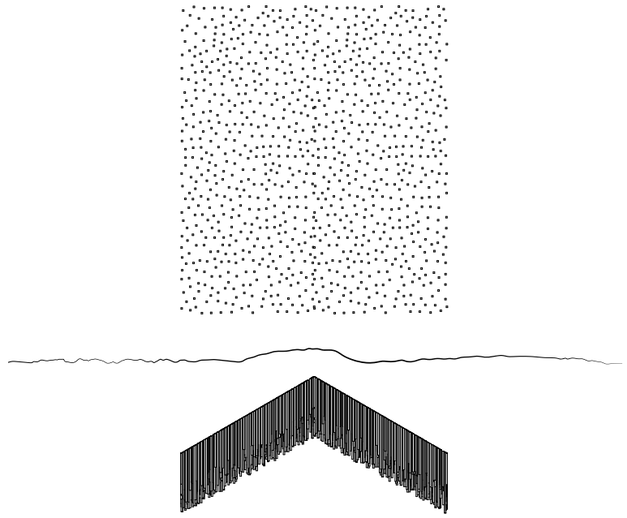
PAVILION NO 4 | NORRSKEN

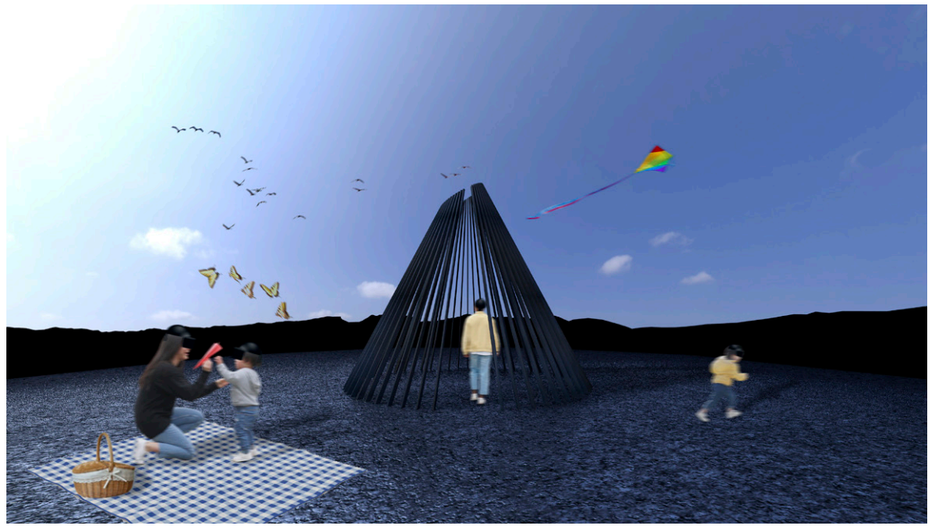
Inspiration: Njalla and icicles

Landscape: Luossavaara

Sky: Northern lights

Drawing scale: 1 : 100





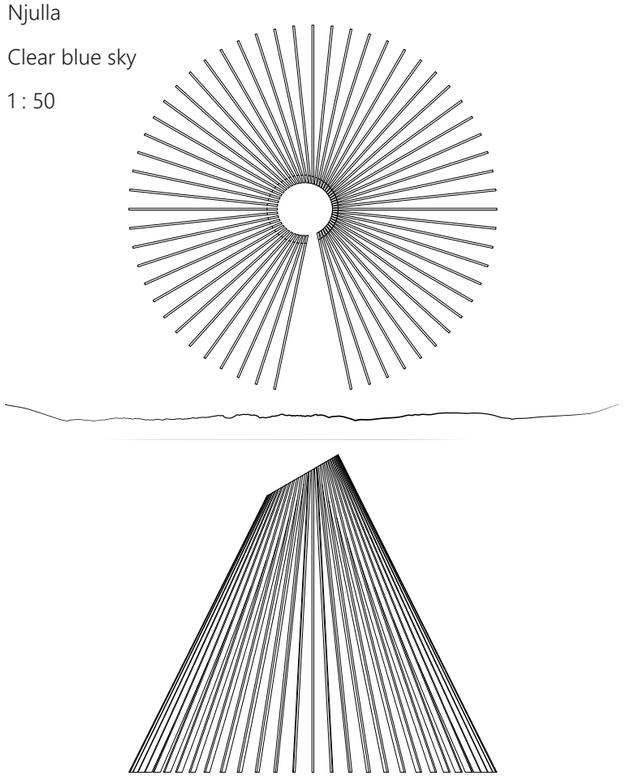
PAVILION NO 5 | KLARBLÅ HIMMEL

Inspiration: Lavvu

Landscape: Njulla

Sky: Clear blue sky

Drawing scale: 1 : 50



DISCUSSION

I Could XR contribute to a richer experience of natural wonders when visiting the north?

Historically, humans have always found it important to entertain and tell stories. We constantly develop our ways to communicate through different formats and dimensions. Spoken words, drawn symbols, written words, paintings, photographs, music, videos etc. For a long time we have relied on visual 2D material but since recently we can design and experience digital spaces and their content in 3D.

Reading about northern lights, seeing pictures of them, hearing from others that have seen them or seeing them ourselves are all different experiences but the more aspects we learn, the greater the understanding.

The question if a sky in XR could replace a real sky is irrelevant, the first will always be a representation of the second. However, with today's technology, things that are not possible in the physical world are now possible in the digital world. To see many different sky phenomena within minutes that normally take place on different times of the day and year is undoubtedly a rich experience.

II Could XR offer alleviation to people suffering from seasonal affective disorder?

This thesis is not a clinical study, nor does it present any new research material to support that the designed exhibition can treat SAD. Sitting in front of a light cube for 30 minutes per day or spending two hours in a room with sufficient lighting are forms of light therapy that is the best available treatment today (Roecklein & Rohan, 2005).

Based on what is stated above and the fact that studies show that XR helps people with other forms of depression (Baghaei et al., 2021) it would not be very surprising if regular visits to the exhibition could help visitors suffering from SAD. Not only does XRAYSCAPE expose the visitor to light, it also deals with what is causing the condition in the first place which is unbalanced exposure to light and offers a clear blue or starry sky depending of the season.

III Could XR help broaden the image of Sámi culture?

The design approach for the whole exhibition is rather minimalistic and abstract which might be considered to be in conflict with the initial ambition of exploring and developing Sámi inspired textures for the pavilions. They are instead designed in cast iron to relate to the mine, a design choice that might push the limits of provocation.

However, pavilions with Sámi influenced shapes are to be found in the exhibition, certainly presented in a more contemporary manner and context than usual. The sound effects from the exhibition are also referring to Sámi culture through the 'jojk' and nature.

A culture with great history and traditions, rooted to its close relationship to nature, can teach us important lessons. If these lessons can be adapted to new formats, they could reach a larger audience and the material can easily get up to date.

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People in visualizations are retrieved from www.skalgubbar.se & www.mrcutout.com

All other visual material is produced by the author

STUDENT BACKGROUND

Denice Ivarsson
denice.ivarsson@gmail.com

Academic background

2020-2023
Chalmers University of Technology | M. Arch. Architecture and Urban Design
Material Turn
Housing Invention
Design & Communication Tools
Residential Healthcare

2022
Universitat Politècnica de Catalunya | Exchange semester
Escola Tècnica Superior d'Arquitectura de Barcelona

2020-2023
Chalmers University of Technology | B. Sc. Architecture & Engineering
Virtual Tools in a Material Culture
Material Methods of Architecture

Practice

2021-2022
SPINN Arkitekter, Oslo
2020
Chalmers University of Technology – teaching assistant

XRAYSCAPE

DENICE IVARSSON