DIGITAL MEDIA STUDIO PROJECT

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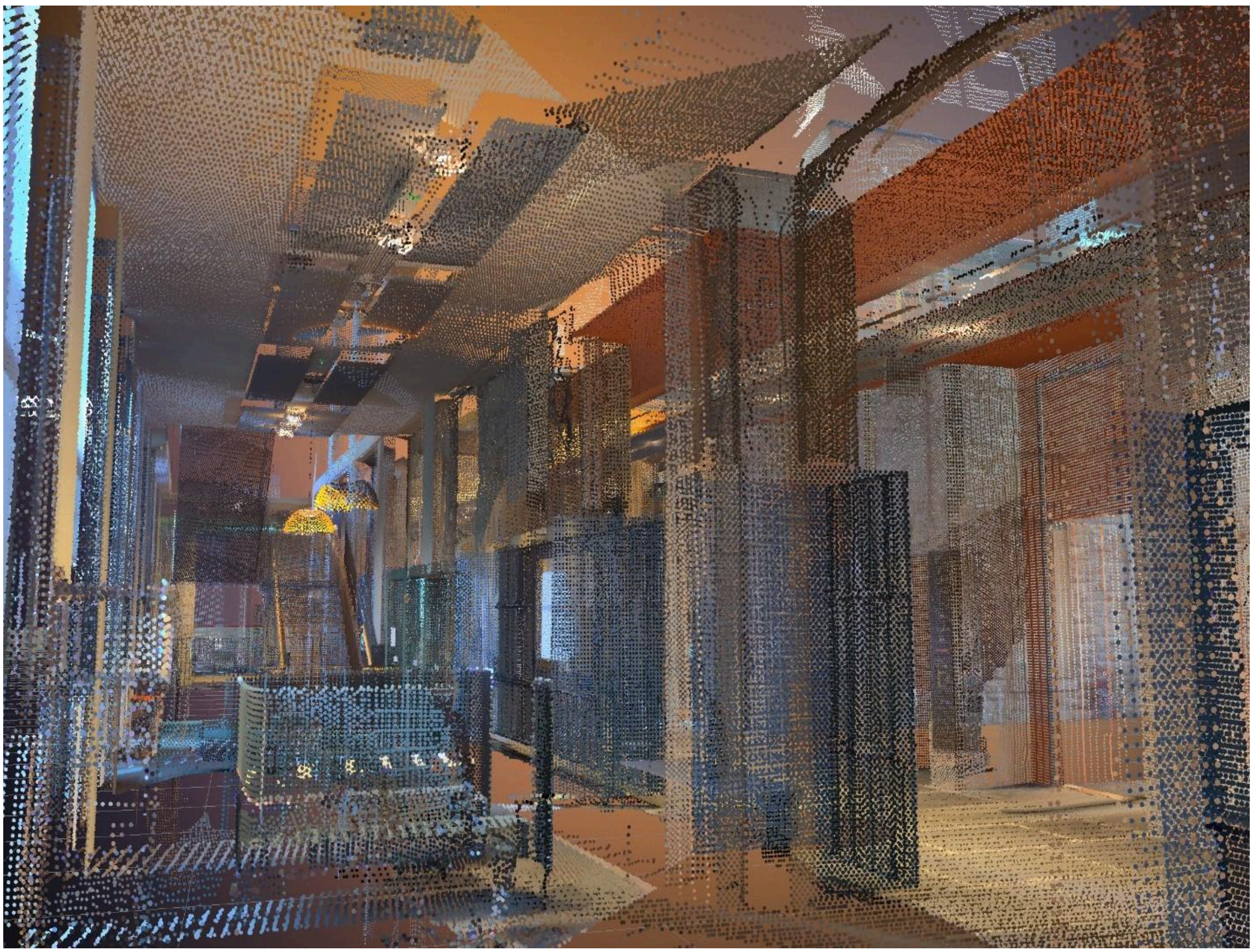

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ABSTRACT

The proposed installation aims to redefine perceptions of Edinburgh by presenting its overlooked architectural elements through an amplified data-informed lens. Utilizing Lidar scanning technology, the project captures intricate details of iconic sites, dissecting them into abstract components. These elements are then projected onto unconventional materials, sourced from waste produced by the University of Edinburgh. By juxtaposing familiar landmarks with discarded materials, the installation challenges viewers to reconsider their preconceptions and engage with the city in a new light. Through this innovative approach, the project seeks to foster a deeper connection between the audience and the urban landscape, encouraging reflection on sustainability, consumption, and the inherent beauty of everyday spaces.

INTRODUCTION

The proposed installation seeks to offer viewers a pulverised perspective on Edinburgh's architectural landscape, challenging conventional notions of beauty and significance. Often, iconic sites in the city are revered for their historical or cultural importance, yet the everyday elements that comprise these landmarks are overlooked. We aim to shift this narrative by leveraging advanced Lidar scanning technology to capture the intricate details and nuances of these structures, dissecting them into their fundamental elements.

In a collaborative effort with the University of Edinburgh, the installation addresses waste management by repurposing discarded materials collected from the university premises. This approach not only promotes sustainability by reducing waste but also adds layers of meaning and context to the project, emphasizing the symbiotic relationship between architecture and environmental stewardship.

At its core, the installation employs an innovative projection mapping technique. Rather than projecting conventional images onto screens or walls, abstract representations of the scanned architectural elements are projected onto the collected waste materials. This juxtaposition challenges viewers' perceptions and prompts contemplation on themes of consumption, waste, and environmental responsibility. By visually intertwining Edinburgh's architectural heritage with waste materials, the installation encourages audiences to critically examine the balance between preservation and progress.

The selection of materials for the installation is deliberate, aiming to create contrast and tension. On one hand, there is the timeless elegance of Edinburgh's architecture, abstractly represented through projections. On the other hand, there is the tangible reality of waste materials, symbolizing the transient nature of human consumption and its environmental impact. This contrast encourages viewers to engage with the installation and reflect on the environmental implications of modern living.

Additionally, the interactive nature of the installation invites viewers to actively participate. As they navigate through the exhibit, they are prompted to consider the relationship between the projected images and the physical materials on which they are displayed. This experiential approach fosters a deeper connection between the audience and the urban landscape, prompting reflection on the intrinsic beauty of everyday spaces and the importance of sustainability in preserving them for future generations.

In conclusion, the proposed installation represents a novel exploration of Edinburgh's architectural identity, blending technology, art, and sustainability in a thought-provoking manner. By recontextualizing familiar landmarks and repurposing discarded materials, the project challenges viewers to reconsider their perceptions of the city and its built environment. Ultimately, it advocates for a more conscious and responsible approach to urban living, inviting audiences to envision a sustainable future for cities worldwide.

LITERATURE REVIEW

There are several prior projects done by artists that have inspired us with the designs and inspiration for our installation.

- Cube Infinite, by The CreatorsProject in 2007

Drawing inspiration from Ming's concept of four-dimensional space, our exploration led us to examine the Cube Infinite project. This project utilized six mirror surfaces arranged into a cube configuration, resulting in a visually disorienting experience when observed through an aperture. This observation sparked our curiosity regarding the potential for achieving a four-dimensional sensation within such a cube, particularly if projections were integrated within it to evoke an infinite realm using scanned images of architectural interiors or exteriors.

Further investigation led us to a video presentation by the studio titled "When Infinity Comes to Life," wherein they elucidate on various interactive installations and their underlying mechanisms. This resource provided insights into the conceptualization and execution of interactive spatial experiences.

Fig 1: When Infinity Comes to Life

Figure 1 illustrates the amalgamation of diverse materials to delineate spatial boundaries. This juxtaposition of materials prompted contemplation on the possibility of utilizing discarded materials sourced from the University to serve as projection surfaces for scanned images. This approach aligns with our aim to repurpose materials while exploring innovative avenues for projecting architectural scans onto unconventional surfaces.

- Ryoji Ikeda’s audiovisual in Amos Rex museum

The art of Japanese composer and artist Ryoji Ikeda (1966) consists of precise soundscapes and moving image. The artist approaches his materials in the manner of a composer. Whether a pixel, sound wave, space or data, Ikeda sees them all as part of the composition process.

Ikeda’s exhibition at Amos Rex draws inspiration from the museum’s extraordinary architecture. On view are five installations, which explore the invisible dimensions of the universe and pushes the limits of perception.

Data Translation : The work translates various data inputs into audio-visual outputs that reorder how we see and hear the world around us. This speaks to Ikeda's broader artistic aim of revealing the hidden structures and patterns that underlie our reality.

Immersive environment: The 2,200 square meter domed underground space, combined with surround sound and large-scale projections, creates an immersive experience that envelops the audience. The industrial hum and vibrations add to this effect.

Hypnotic, meditative visuals: Works like "mass" feature repetitive, pulsing geometric animations that have a hypnotic, trance-like quality. They act as visual mantras that captivate attention and inspire imagination.

Perceptual phenomena: Many of the works leverage illusory effects, afterimages, and optical tricks to engage the viewer's perception. For example, "spin" uses a rotating laser projection to create a flickering 3D/2D effect.

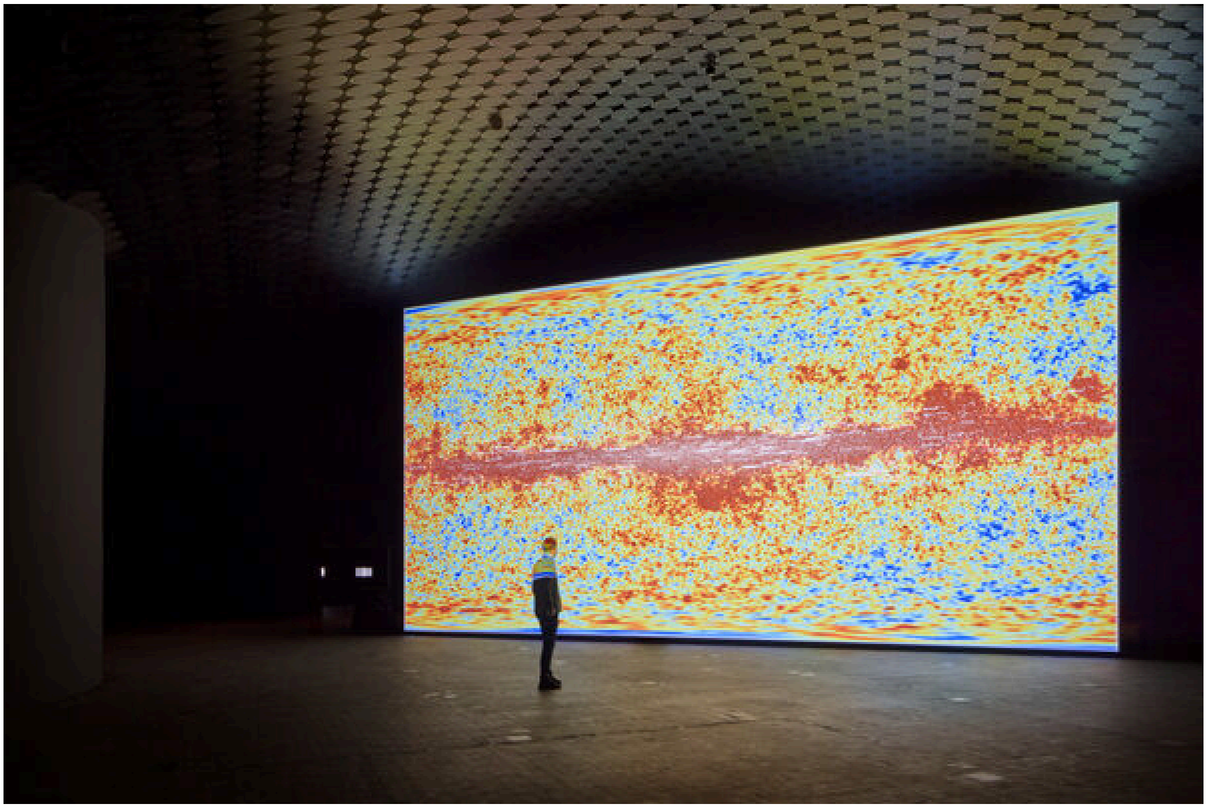


Fig 2 : Showing an installation of Ryoji Ikeda in Amos Rex

- Ryoichi Kurokawa's "s.asmbli [wall]

LiDAR, as a contemporary high-tech innovation, has inspired audiovisual installations that often employ nearly sci-fi sonic textures to reflect their technological essence. These installations predominantly use synthesizers and processors to create sounds, aiming for an auditory experience that matches the visual in its capacity to transport audiences beyond the familiar. The sound design in these setups focuses on dynamic and timbral shifts that keep pace with visual transformations, emphasizing rhythm and atmosphere rather than conventional melody.

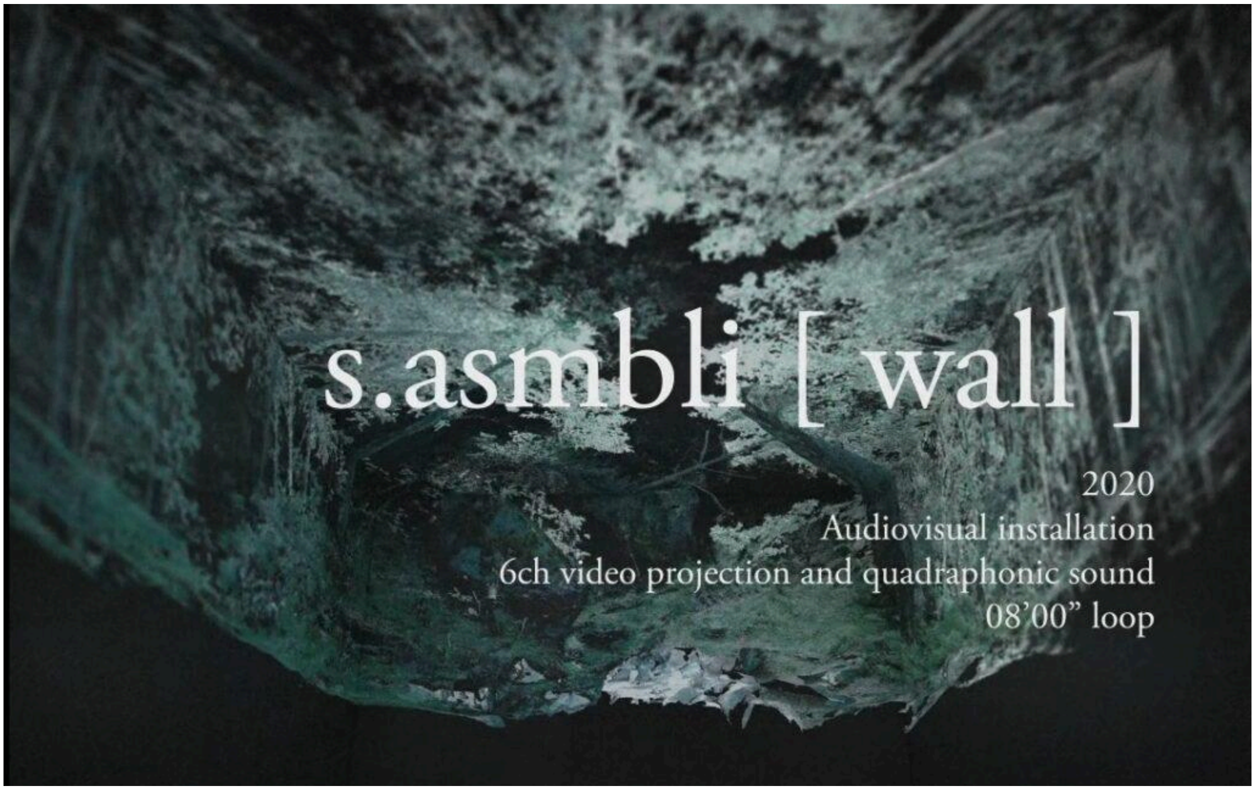


Fig 3: s.asmbli [wall]

A notable example in this domain is Ryoichi Kurokawa's "s.asmbli [wall]," where sound plays a pivotal role in creating the atmosphere and making the LiDAR scanning process audible. The installation capitalizes on the rhythmic aspects of the scanning to set its tempo, relying mainly on synthesized sounds without clear melodic content. It employs reverberation automation to reflect changes and progressions within the scene, enabling the audience to intuitively understand the creation and evolution of data. This immersive experience guides viewers through the construction, transformation, and dismantling of various places, driven by the combined narrative of sound and visual.

The adoption of technologically derived timbres is intended to signal the processes underlying the visual display, employing nondiegetic sounds to hint at the artificial crafting of these places. This strategy not only deepens the immersive effect by linking technology with creativity but also prompts the audience to consider the interplay of human and technological efforts in depicting and altering environments. Installations like Kurokawa's encourage exploration of the relationship between organic and technology, showcasing the artistic possibilities offered by LiDAR.

MATERIAL ANALYSIS

WATER:

Characteristics: Reflective, dynamic, fluid.

Visual Impact: Projections on water surfaces will ripple and distort, creating an ever-changing and ephemeral effect. Reflections add depth and complexity to the visuals, enhancing the overall immersive experience.
Sound Correspondence: Water sounds such as gentle waves or splashing add an auditory dimension to the installation, enhancing the sensory experience.

STONE:
Characteristics: Solid, textured, rough.
Visual Impact: Projections on stone surfaces will retain texture and may appear slightly muted or subdued. The roughness of the surface adds a tactile quality to the visuals, creating a sense of groundedness and solidity.
Sound Correspondence: Stone surfaces may evoke sounds of echoes or reverberations, enhancing the overall auditory ambiance.

TREES:
Characteristics: Organic, textured, irregular.
Visual Impact: Projections on tree surfaces will interact with leaves, branches, and natural contours, creating a layered and immersive effect. The irregularity of tree surfaces adds depth and complexity to the visuals, blurring the boundaries between nature and artifice.
Sound Correspondence: Tree surfaces may evoke sounds of rustling leaves or creaking branches, enhancing the naturalistic ambiance of the installation.

CURTAINS:
Characteristics: Soft, flexible, semi-transparent.
Visual Impact: Projections on curtain surfaces will appear diffuse and ethereal, with images subtly shifting and changing as the fabric moves. The semi-transparency of curtains adds a sense of mystery and intimacy to the visuals, inviting audiences to peer through layers of fabric.
Sound Correspondence: Curtains may evoke sounds of gentle rustling or swishing, enhancing the atmospheric quality of the installation.

MIRROR:
Characteristics: Reflective, smooth, polished.
Visual Impact: Projections on mirror surfaces will be mirrored back to the audience, creating a sense of infinity and doubling the visual impact. The smoothness and polish of mirror surfaces enhance clarity and sharpness, allowing for precise and detailed projections.
Sound Correspondence: Mirror surfaces may amplify sounds, adding a sense of resonance and depth to the auditory experience.

Projecting an Image onto Water, Windows, and Other Challenging Surfaces - GoboSource

METHODOLOGICAL FRAMEWORK

Protocols

Several key protocols underpin the technical implementation of the Edinburgh Perspectives installation:

- LiDAR Scanning: A terrestrial laser scanning approach will be utilized to capture detailed 3D data on architectural structures, landscapes, and public spaces throughout Edinburgh. Scanning resolution and coverage will be optimized to collect nuanced information on surface geometries and spatial configurations.
- Field recording: To capture diverse soundscapes in Edinburgh with precision and innovation, we'll employ the ORTF technique for detailed stereo recordings and an Ambisonic microphone for capturing immersive spatial audio. Our approach includes Recording Perspectives ranging from distant to close-up shots, capturing everything from broad spatial layers to intricate sound details. Additionally, we'll utilize impulse responses with slapsticks and balloons to record the unique acoustic signatures of various environments.
- Spatial audio: For our simulated Edinburgh immersive experience, it's essential to employ strategic spatial audio techniques. To achieve this, our recording plan incorporates the Ambisonic format for mixing, to utilize a 5.1 (or 5.0) surround sound playback format to immerse the audience.
- Data collection and rendering: Point cloud outputs from LiDAR scans will be manipulated using software like CloudCompare to extract key data parameters and convert datasets into workable formats. Details like point intensity, density, and colorization will be accessed.

Field Research

- Sites: Various locations that are a part of Edinburgh's characteristics.
  St Giles' Cathedral
  Portabello beach
  Meadows
  Vennel steps
  Criagmiller castle
  Gilmerton Cove
  Dirleton Castle

- Objects: Elements within sites like monuments, follies, sculptures, water features, trees, bridges etc. will be scanned and evaluated as points of visual and sonic interest. These may become focal points within the installation.

- Phenomena: On-site exploration will unpack the experiential qualities of spaces, from light play and acoustics to surface textures, assessing how environmental factors shape perceptions of place. These will inform data translation approaches.

DATA COLLECTION

SCAN DATA

- Scans using Lidar Scans by analyzing the optimum points for scanning the entire scanned area.
- Importing point cloud data:
  Firstly, you need to import the point cloud data scanned by the LiDAR into the computer software of your choice. Many 3D modelling software support importing point cloud data, such as MeshLab, CloudCompare, etc.

- Cleaning and filtering:
  Lidar scanned point cloud data may contain noisy or irrelevant points that need to be cleaned and filtered. This can be done by removing outlier points, performing smoothing operations, or applying other filters.

- Point Cloud Reconstruction:
  After cleaning and filtering, you can use point cloud reconstruction algorithms to convert the point cloud data into a surface mesh, which means that the points in the point cloud are connected to form a surface. This can be done with algorithms such as Poisson Reconstruction, and Marching Cubes.

FEILD RECORDING PLAN

Dual Microphone Sets

- Stereo(ORTF): This set will employ the ORTF stereo technique to ensure high-quality 2-channel stereo recordings. This approach is aimed at capturing a rich, natural sound field.
- Ambisonic: In parallel, we will use an Ambisonic microphone to capture sounds in the first-order Ambisonic format. This technique is chosen for its ability to preserve the spatial characteristics of the soundscape, offering a more immersive listening experience.

Recording Perspectives

- Distant Shots: Aim to capture a broad spatial layering, retaining the scene's depth.
- Medium Shots: These should align with everyday auditory habits, ensuring there are plenty of dynamic changes.
- Close-up Shots: Focused on detailing specific sounds within the environment, these recordings will be more targeted, serving potentially as sound effects or sonification elements, rather than general ambience.

Impulse responses

- To record the acoustic reverberation of different places, we plan to use a slapstick and balloons to create impulse responses, allowing us to capture the unique acoustic signatures of various spaces effectively.

Equipment List

1. Microphone
Sennheiser AMBEO VR mic
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=4149

Schoeps - MK4 + CMC1L * 2

2. Portable Field Recorder
Sound Devices - MixPre-6 II
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=9483

Zoom - F8（backup）
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=4175

3. Accessories
Toca - Slapstick
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=7135

Rycote - Cyclone - Fits Schoeps MK4 Pair
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=10052

Rycote - Cyclone - Fits Sennheiser AMBEO
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=10049

K&M Mic Stand * 2
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=8261

Sound Devices - Battery
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=1509

AA Battery Charger
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=10083

AA Rechargeable Batteries x 4 *2
https://bookit.eca.ed.ac.uk/av/wizard/resourcedetail.aspx?id=6024

ENVIRONMENTAL DATA

Details on lighting conditions, site acoustics, surface textures, geometries, colors, and other variables will be logged to guide data processing and technical setup.

CASE STUDY ON DATA COLLECTION

Case Study 1: LiDAR Scanning of the Old Medical School

Context and Objectives
The Old Medical School, one of the oldest medical schools with substantial architectural height, was selected as the primary site for implementing LiDAR scanning techniques acquired from uCreate training.

Technology Selection
The BLK360 G1, with its extensive range capabilities, was chosen for its ability to capture the full scope of the building's façade, which was critical for the comprehensive data collection required for this historic structure.

Scanning Methodology Adjustment
Initial plans to conduct a central scanning operation were altered upon discovery that the extremities, specifically the corners, were not being captured effectively. A strategic decision was made to scan from point 2, facilitating a seamless integration with point 3's scan for complete data stitching.

Adaptive Scanning Strategy
Faced with the challenge of scanning the entire site in one session, the team adapted their approach by employing multiple scanning points and conducting repeat scans to ensure accuracy. This underscored the importance of pre-planning scanning operations according to the unique characteristics of each site to achieve complete data acquisition.

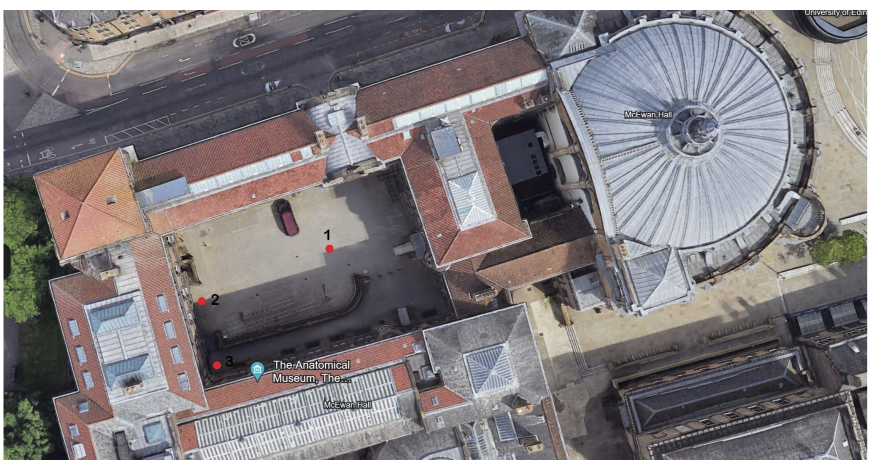


Fig 4: The Old Medical School scan point

Case Study 2: LiDAR Scanning at the Edinburgh Futures Institute

Selection Rationale

The Edinburgh Futures Institute was selected for the second case study due to its historic significance within the University of Edinburgh and its embodiment of modern challenges and educational methods in its architecture, providing a rich comparison to the Old Medical School.

Advanced Scanning with BLK360 G2

For this second scan, the advanced BLK360 G2 was utilized for its enhanced scanning speed and high-precision range. The process was divided into two distinct phases: classroom scans to establish building dimensions and detailed corridor scans to capture the finer architectural elements.

Classroom Scanning

The first phase involved scanning from each classroom corner, capturing detailed measurements to establish the building's spatial dimensions. This provided a foundational layout from which further details could be extrapolated.

Corridor Detail Scanning

The second phase focused on the internal corridors, using an inside-out scanning approach. This comprehensive method yielded not only spatial data but also detailed color, intensity, and textural data, which would be vital for future design considerations.

Data Processing and Workflow

The data processing stage was crucial in understanding the storage and manipulation of point cloud data. The team gained expertise in selecting and filtering data, as well as in mastering the software workflow necessary for processing LiDAR data, which included:

Initial data capture with the LiDAR scanner.
Data synchronization via Cyclone FIELD 360 on an iPad.
Point linking and exportation in a specified format.
Importation into Cyclone REGISTER 360 for editing.
Selection of specific data attributes for final export, detailing key characteristics like distance, color, and material properties.

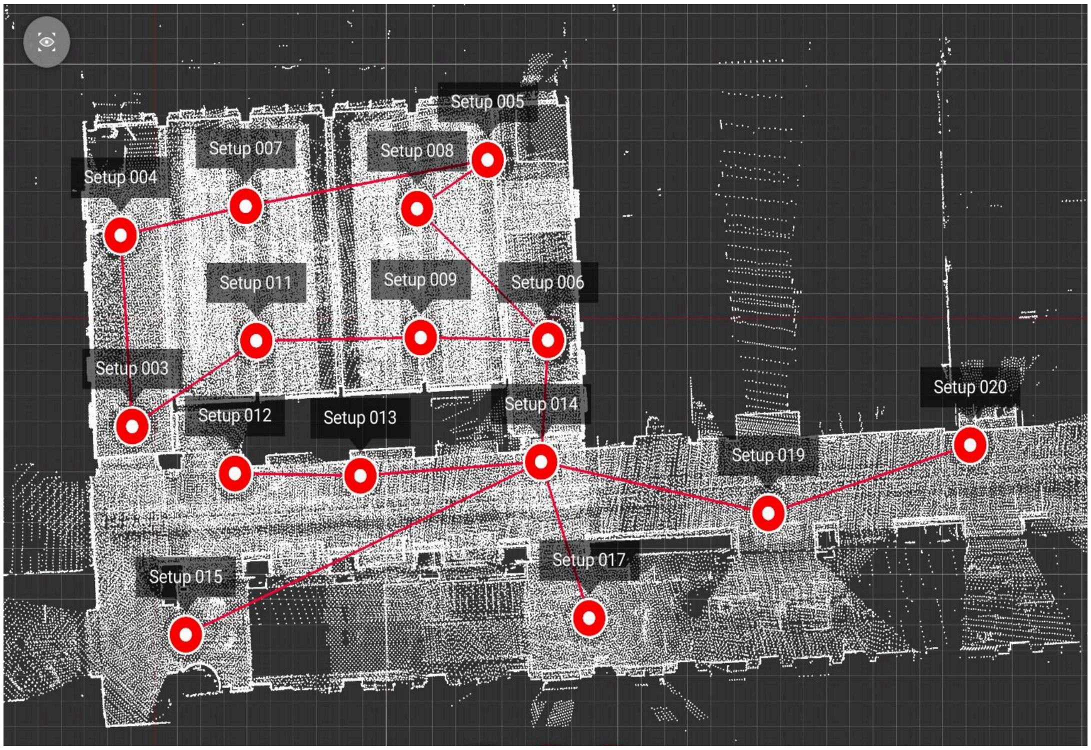


Fig 5: EFI scanning point

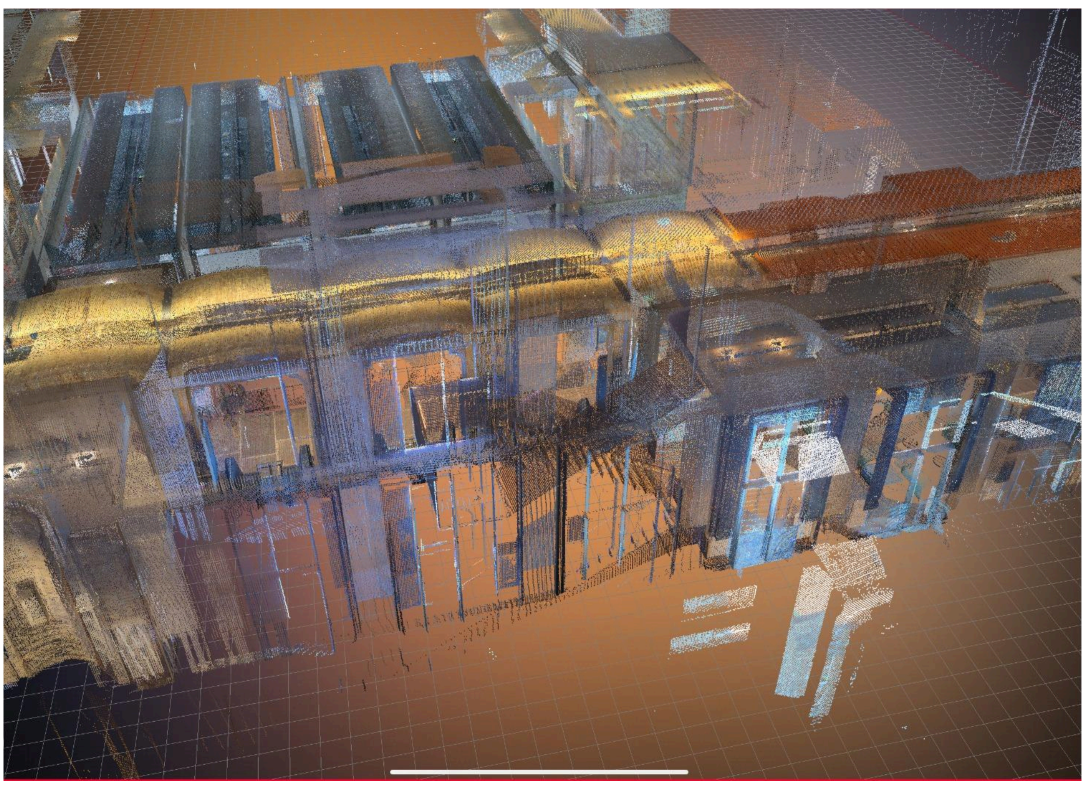


Fig 6 : EFI scan 3D map

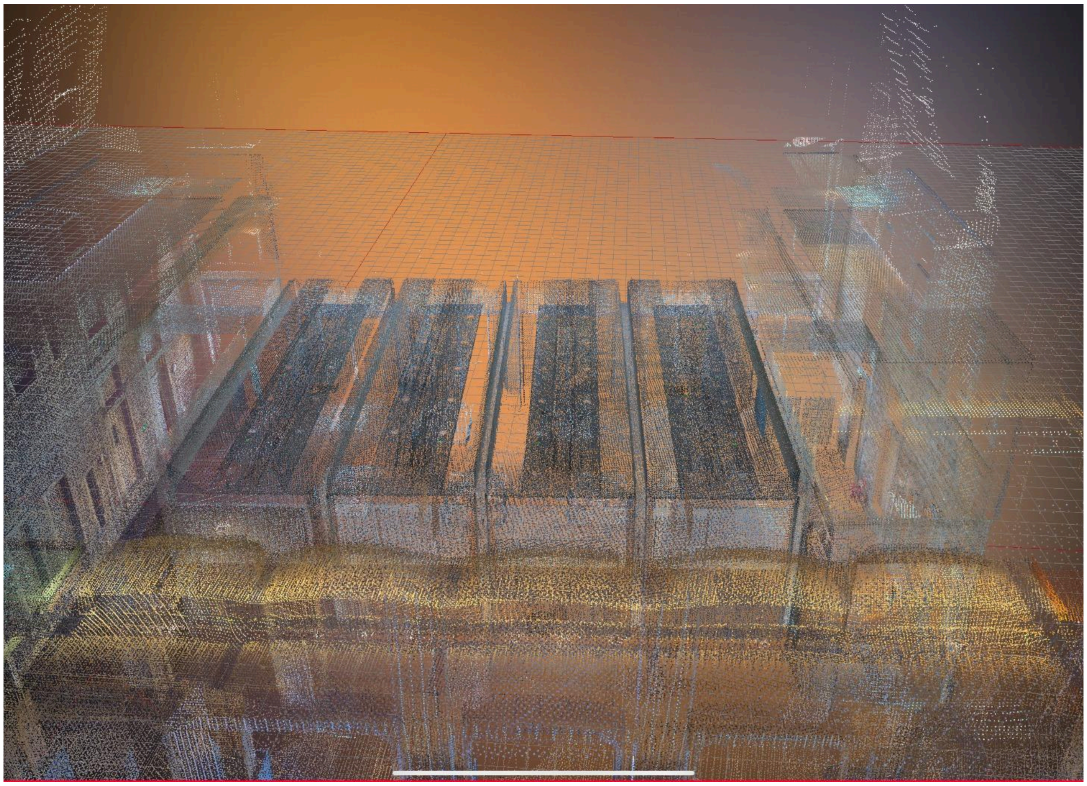


Fig 7: EFI scan 3D map

Fig 8: EFI scan 3D map

Fig 9: EFI scan 3D map

Fig 10: EFI scan 3D map

REFLECTION

The combination of visuals and sound in films brings us an immersive experience, where sound plays a crucial role in shaping immersive spaces.Michel Chion categorizes film sound into two parts in "Audio-Vision: Sound on Screen": Diegetic, which is sound within the narrative space, and Non-Diegetic, which is sound outside the narrative space. The interplay and transformation between these two types of sound create a sensory immersion for the audience.Meanwhile, Ben Winters mentions in "The Non-diegetic Fallacy: Film, Music, and Narrative Space" that Non-Diegetic sound is partly a sign of the fictional state of the world created on screen.Therefore, can we apply the theories of Michel Chion and Ben Winters to art installations, making sound an indispensable part of sensory immersion and allowing sound to work with visuals to create a field within the “Place” of this installation?

Sound is divided into two parts: Diegetic and Non-Diegetic. Diegetic refers to Place Sonification, while Non-Diegetic refers to LiDAR Sonification.In Diegetic sound, we use sounds that are closer to the real world, which can give the audience a sense of familiar unfamiliarity. This type of sound can shorten the distance between the audience and the space of the installation.In Non-Diegetic sound, we primarily use sounds from synthesizers, which are very distinctive and can quickly capture the audience's attention.Through the combination of Diegetic and Non-Diegetic sounds, the entire installation's field is placed at the intersection of reality and virtuality, making it both real and beyond reality.

OUTCOME

Experiential Outcomes

- Providing locals and visitors with novel encounters with Edinburgh that challenge perceptual habits and foster appreciation for the city from uncharted vantage points.
- Crafting multi-sensory, digitally augmented environments blending virtual and real, natural and artificial, through projected visuals and soundscapes.
- Offering interactive, playful art experiences through dynamically generated content responding to changing site factors like lighting conditions, viewer movement, ambient sounds, etc.

Technical Outcomes

- Advancing creative applications of LiDAR scanning, field recording, and projection mapping through an ambitious multi-site installation leveraging these technologies.
- Establishing robust methodologies for scanning varied urban and natural environments, translating scan data into sensory effects, and calibrating installations across diverse locations. Experiment with techniques for weaving together numerous projection

surfaces, scanned data, computer graphics, and surround sound within a coherent experience.

LiDAR technology, which captures environments to generate point cloud data, provides a distinctive avenue for uncovering the hidden characteristics of a location through sound. By selecting data points that hold particular relevance for auditory interpretation, these elements can be converted into sounds that are perceptible to an audience. The point cloud data obtained from LiDAR scans can be converted into a CSV format readable by Max/MSP using CloudCompare, facilitating the manipulation of audio based on data.
In this project, the intention is to use granular synthesis to represent the granularity of point cloud data. By controlling arguments such as grain rate, duration, pitch, and amplitude in real time based on the data from the place, the variation within the point cloud data can be audibly demonstrated. Moreover, Max/MSP allows for further sonification through data input, such as using the data to control the parameters of processors and synthesizers or triggering specific samples with extreme values. This approach enables real-time sound matching based on visual effects, bringing the scanned environment to life uniquely and engagingly.

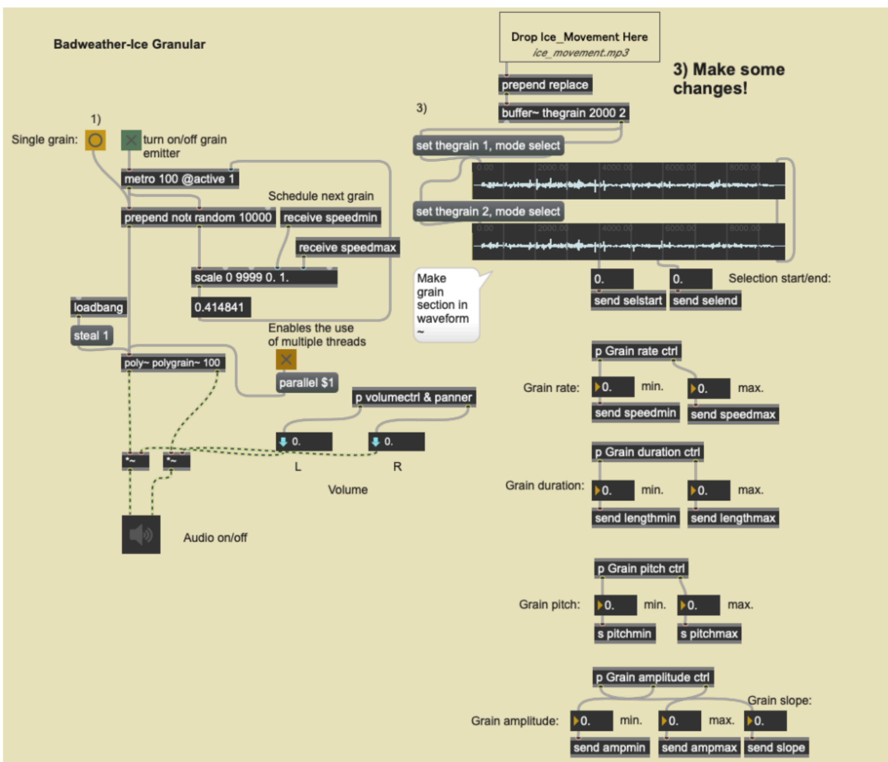


Fig 11: A granular synthesizer in Max/MSP.

DOCUMENTATION

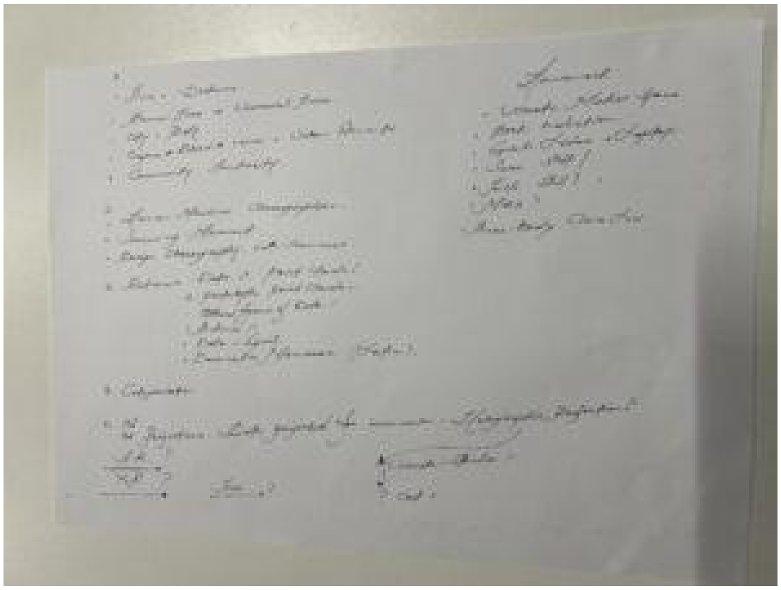
This section serves as a brief summary of several meetings held up to the time of Submission 1, and is used as an outline; details of each meeting can be found in other sections of the Blog.

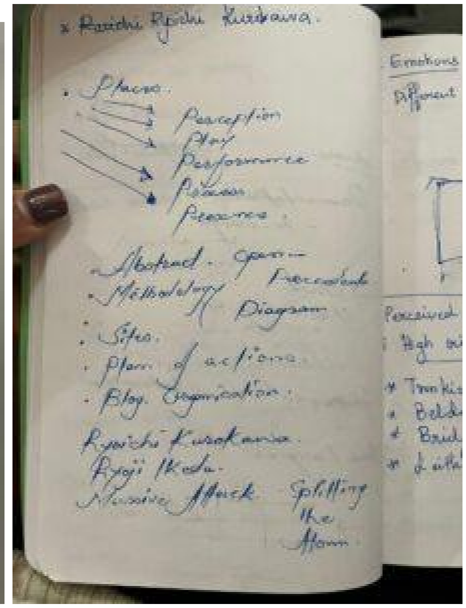
January 25th, 2024

Theme of the Conference：Group members met after class to learn about our professional backgrounds, software us specialise in, and to set up a Miro, whatsapp group for future communication.Additionally, we confirmed with Asad email that the meeting will take place every Friday.

January 26th, 2024

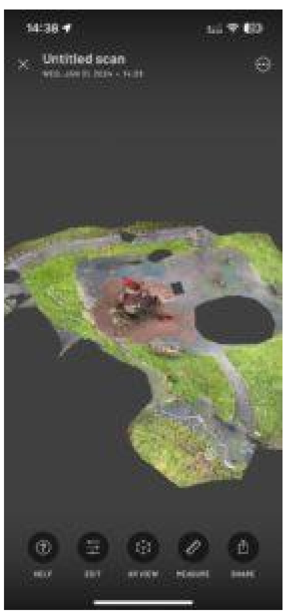
Theme of the Conference：The first formal meeting to learn from Asad about the relationship between data and Place and how we should go about applying that data, in addition to watching some videos made from the data we got from the radar scans, which helped us to get a better understanding of the topic of the class, and after the class we each came up with our own ideas for the project we were going to work on.





February 1st, 2024

Theme of the Conference: We didn't get to borrow radar equipment as our school wasn't able to train us this week, but we still did some scanning via our mobile phone apps.

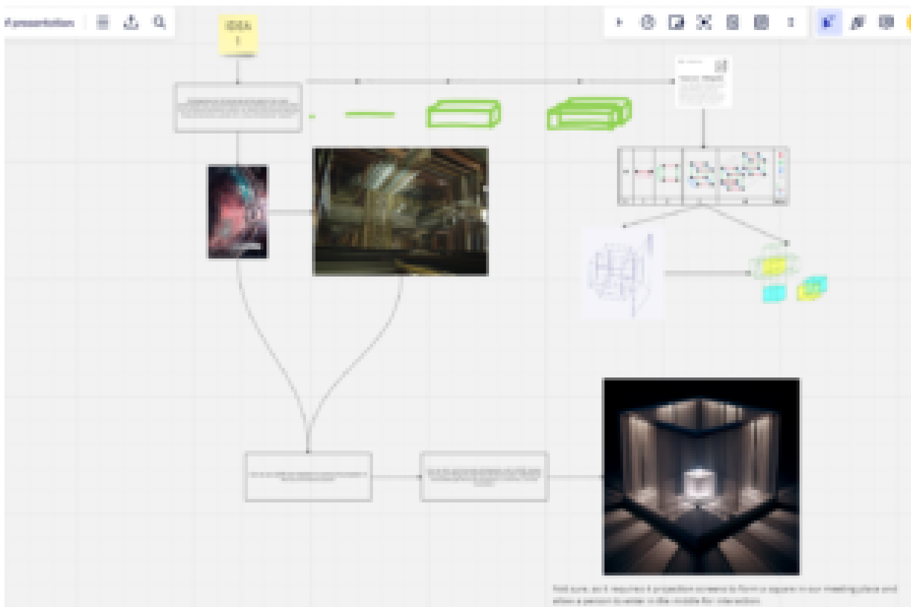


In addition, we have come up with some ideas for this assignment, the exact details of which can be found in the Blog.

February 2nd, 2024

Theme of the Conference : For this meeting we consulted Asad and we planned and summarised our previous ideas in detail, in addition we considered the feasibility of the individual plans.

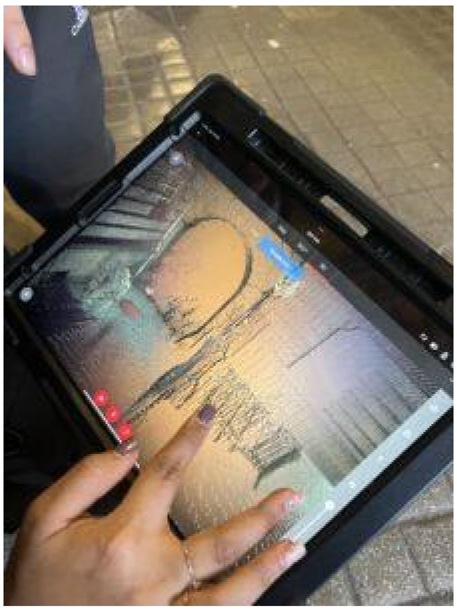
As none of us are familiar with the effects of radar scanning, at Asad's suggestion we will start by picking a few locations around the school to scan and see how it works. After having a detailed understanding of the radar we will proceed to the next step.



February 5th, 2024

Theme of the Conference : We spent the day training on the radar instrument, learning the basic operating principles and use of the radar, and were given a week's worth of radar to use.

In addition, we chose a suitable location within the campus to conduct a field survey after the training was completed.



February 8th, 2024

Theme of the Conference： In this meeting, we have consolidated the results of the previous meetings in order to come up with a general draft of the programme, and we have decided to bring different experiences to the audience by projecting the data from the radar scans onto different materials.In addition, we have selected a video for reference.

https://youtu.be/hUbweJG68SI?si=fGwY7W-NqDL3AEZz

February 9th, 2024

Theme of the Conference：Based on yesterday's meeting, we held this online meeting mainly to determine everyone's responsibilities in the project, with Akshara in charge of the data collection statistics and model presentation part, YiFei in charge of the visual effects and project documentation part, and MingDu and QingLin managing the sound design as well as the conversion processing between the data and the sound effects.

February 12th, 2024

TIME TABLE

Week1	Lecture Learning
Week2	Meeting with tutor and brainstorming
Week3	Completion of initial idea sketch
Week4	Research, Lidar training, and data collection and scanning
Week5	Refining ideas, data collection, and scanning
Week 6-10	Data collection, scanning, and material editing
Week 11	Creation of installation prototype
Week12	Site selection and setup

Week13	Indoor testing
Week14	Modification and refinement of the installation

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Ikeda, Rjoji .Audiovisual in Amos Rex museum

Cube Infinite, by The CreatorsProject in 2007

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