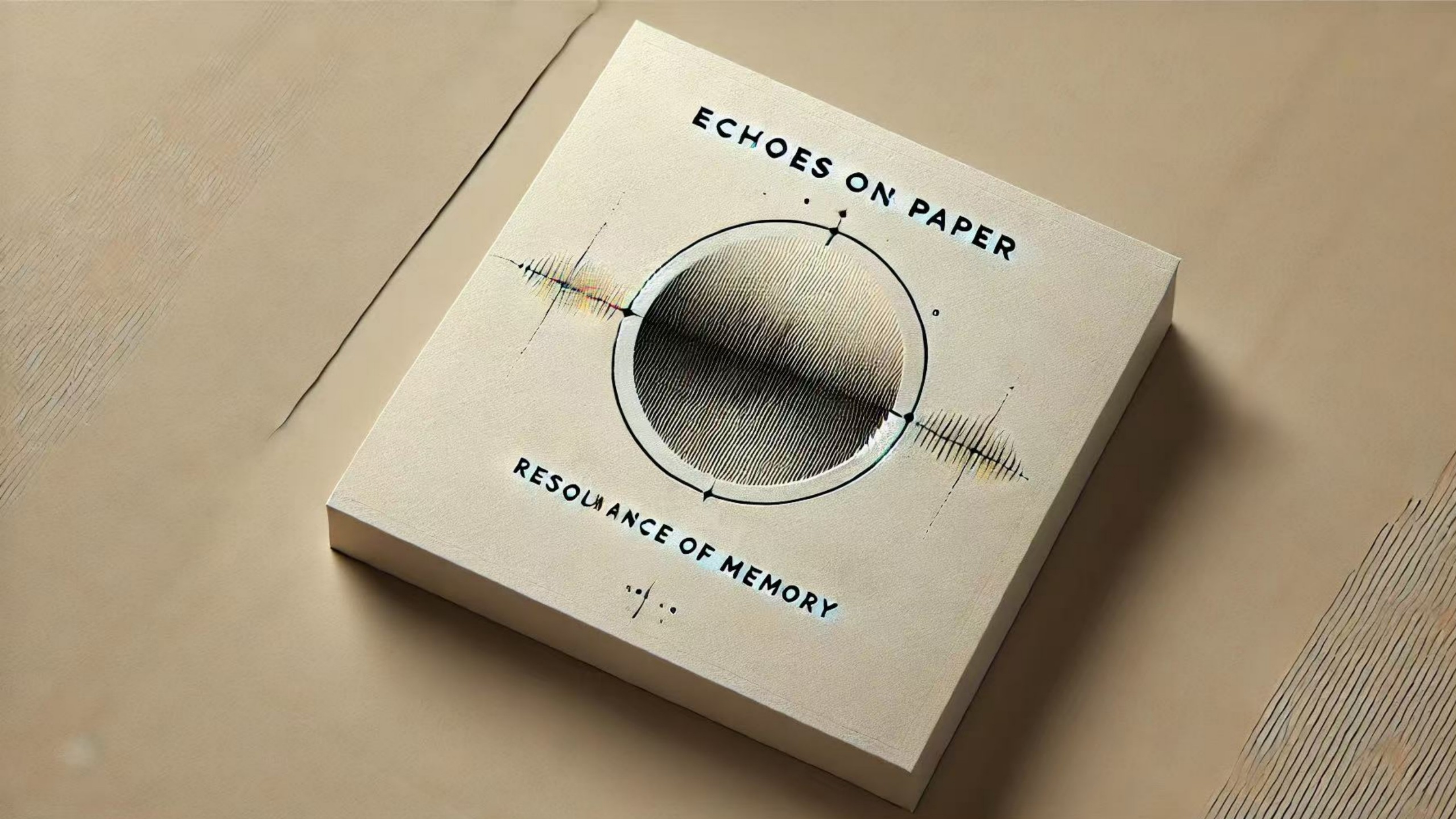
ECHOES ON PAPER
RESOU ANCE OF MEMORY

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Background Store

In the historic and artistically rich city of Edinburgh, a paper factory lies forgotten. Once a place that produced the carriers of culture—books, newspapers, archives—it was home to the printed word, to history, to thoughts. But now, its machines have fallen silent, paper no longer glides across its production lines, and the voices of workers have vanished into the air. The faded stains on the walls mark the passage of time, a fusion of damp air and history. The stories of this place have been sealed away, left to decay in silence.

Yet, memory does not truly vanish. It lingers in the echoes of sound, embedded in the air, the bricks, and the floors, waiting to be uncovered. If paper can carry thoughts, could it also store sound? Do the voices of the past still exist, hidden in another form, waiting to be heard?

You are a "sound archaeologist," stepping into this space with your equipment, determined to unearth the sonic remnants of the factory. Are you listening to the lingering rustle of paper from the past, or is it merely an AI-generated noise from a distant future?

As you explore, the space begins to respond to your presence. The sounds shift and evolve—not just remnants of the past, but something reshaped by your actions. Cracks in the walls seem to whisper, the factory's long-forgotten clamor rises once more. But the sounds are incomplete, fragmented, distorted—they are remnants of the past, present, and future colliding in a single moment.

Can you reconstruct these lost echoes and piece together the factory's forgotten history? Or are these sounds merely fragments of memory, fleeting and incomplete, destined to fade back into silence?

Yet, memory does not truly vanish. It lingers in the echoes of sound, embedded in the air, the bricks, and the floors, waiting to be uncovered. If paper can carry thoughts, could it also store sound? Do the voices of the past still exist, hidden in another form, waiting to be heard?

You are a "sound archaeologist," stepping into this space with your equipment, determined to unearth the sonic remnants of the factory. A microphone captures faint echoes in the air, Leap Motion tracks your hand movements, allowing you to "turn the pages" of history, while Kinect maps your footsteps, altering the soundscape with every step. Are you listening to the lingering rustle of paper from the past, or is it merely an AI-generated noise from a distant future?

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Or are these sounds merely fragments of memory, fleeting and incomplete, destined to fade back into silence?

Concept Overview

"Echoes of Paper: Resonance of Memory" is an immersive interactive art installation based on sound-visual linkage. It uses **LiDAR scanning, TouchDesigner visual generation, Max/MSP** and **Logic Pro** sound processing to explore the time layers of The Paper Factory in the past, present and future.

The core goals of this installation are:

✅ Digitize the physical space and build a dynamic 3D visual model.

✅ Collect and process the factory's on-site sounds to reconstruct the sense of time layers.

✅ Drive the changes in 3D visual forms through sound to achieve real-time sound-visual linkage.

✅ Allow the audience to influence the sound and vision through interaction and shape their own "memory" experience.

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Graphic Design —— Multiple Boundaries of Sound

Exploring Visual Presentation & Interaction with TouchDesigner

Authors: Jiaming Li, Siming Shen

Design Process

The visual interaction design of this project first explores how sound influences spatial perception by defining the themes of "place" and "non-place" and designing interactive methods. Using tools like TouchDesigner, we will employ sound spectrum analysis and real-time algorithmic generation to create visual effects such as particle systems and fluid simulations, merging sound changes with visual effects.

The audience's interactive behaviors, such as position and gestures, will directly impact the changes in the visual effects, gradually presenting the transition from a stable sense of place to a chaotic sense of non-place. The entire process requires repeated testing and adjustments to ensure smooth interaction, ultimately presenting an immersive experience that integrates sound, visuals, and interaction.

Overview

Concept Definition:

1

Clarify the theme: the transition from "place" to "non-place."
Design interactive methods to explore how sound shapes spatial perception.

Visual Design:

2

Leverage advanced tools such as TouchDesigner to translate sound spectrum analysis into dynamic visual effects, including but not limited to particle systems, fluid simulations, and other generative visuals.
Establish a close relationship between the characteristics of sound (frequency, intensity, pitch, etc.) and corresponding visual transformations, creating a cohesive, sensory-driven experience where auditory stimuli directly impact visual perception.

Interactive Design:

3

Develop an interactive framework in which the audience's actions—such as spatial positioning, movement, and gestures—actively influence the evolution of visual effects. This interaction serves to guide the user through a gradual shift, from a stable and familiar "sense of place" to a fragmented and disorienting "sense of non-place."
The interaction not only alters visual aesthetics but also enhances the thematic experience of displacement and transformation.

Testing and Optimization:

4

Engage in multiple cycles of rigorous testing and refinement to ensure that interaction responses are swift, intuitive, and immersive, with particular attention to real-time feedback loops between the user's actions and the resulting visual changes.
Optimize the seamless integration of sound design and visual effects, ensuring they work in harmony to create a fluid, immersive experience that is both responsive and coherent.

Audio Input and Preprocessing

Audio File In: Capture various recorded audio sources, including environmental sounds, mechanical noises, worker dialogues, etc., providing material for subsequent sound analysis.

Audio Analysis: Perform FFT (Fast Fourier Transform) spectral analysis on the input audio to extract features such as intensity, rhythm, and frequency, providing data support for the visual interaction control.

Audio Reactive Control: Map the extracted audio features (such as intensity, frequency, rhythm, etc.) to visual elements, controlling changes in effects like particles, lighting, and shapes, enabling real-time interaction between sound and visuals.

Echoes of the Past

TouchDesigner Implementation:

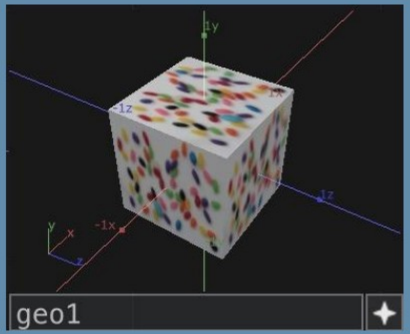
·Particle System:
Simulate floating paper reacting to low-frequency audio vibrations, creating dynamic changes in the space.

·Noise Texture:
Simulate smoke from steam engines using noise textures, visually representing the engine's operation.

·Geometry Instancing:
Use geometry arrays to simulate rotating gears that respond to low-frequency vibrations.

·Lighting Dynamics: Create point light sources to mimic the dim, mechanical lighting of the factory.

Interaction Methods:



·Audience movement triggers sounds like machine roars and steam releases, while factory lights illuminate accordingly.

·Interactions with virtual paper trigger worker whispers or machine sound effects, immersing the audience in the factory environment.

Empty Present

TouchDesigner Implementation:

·Displacement Mapping:

Simulate cracks in walls and depressions in floors, showing the factory's dilapidation.

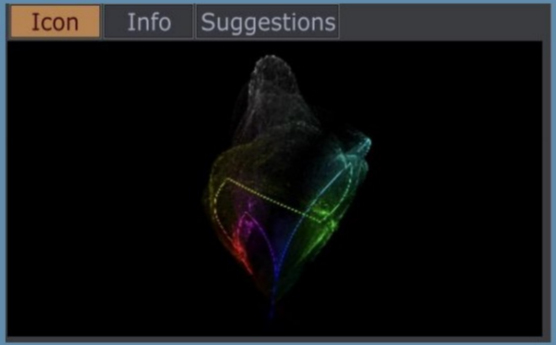
·Low Light & Fog Effects:

Use low light and fog to enhance the feeling of emptiness and stillness.

·Occasional Glitch Effects:

Introduce brief glitches in visuals and sound to simulate the distortion of memories and time.

Interaction Methods:



·Audience movement triggers echoes of the past, such as machine sounds or worker whispers, giving a sense of time travel.

·Using Leap Motion, the audience can "touch" walls, triggering sounds or images from the past, blending memories and the present.

Possible Future

TouchDesigner Implementation:

·Generative Design:
The factory's design evolves in real-time based on audience input and audio, with elements like machinery and layout adapting dynamically.

·Hologram UI:
Interactive, particle-based holographic displays simulate futuristic interfaces, allowing the audience to control and interact with the factory's systems.

·AI-driven Animation:
Audio data drives real-time adjustments to the factory's structure and equipment, simulating intelligent, self-adjusting factory operations.

Interaction Methods:

·Future Factory Selection:
The audience can choose different future factory concepts (eco-friendly, mechanical, digital, etc.), which change the factory's visual appearance and functionality.

·Voice Commands:
Voice inputs allow the audience to trigger transformations in the factory, showing how smart technology can interact with users in the future.

Interaction Design

Different Areas Trigger Soundscapes:

As the audience enters different areas, the sound effects change, such as factory machinery sounds, steam noises, etc.

"Memory Mode":

When standing still in a specific location, the scene enters "Memory Mode," triggering past factory sounds and memories.

Based on Spatial Position

Based on Gestures (Leap Motion / Kinect)

Based on Sound (Microphone Input)

Touch Gesture:

When extending the hand to touch, memory sound effects like worker conversations or machine sounds are triggered.

Palm Rotation:

Rotating the palm causes gears to rotate or changes the future architectural form, allowing participation in virtual factory operations.

Speech Triggering Echoes:

When the audience speaks, past worker voices or machine echoes are triggered.

Shouting Keywords:

Saying keywords like "future" triggers a scene transition to the future, changing the environment's sound and visuals.

Devices and System Architecture

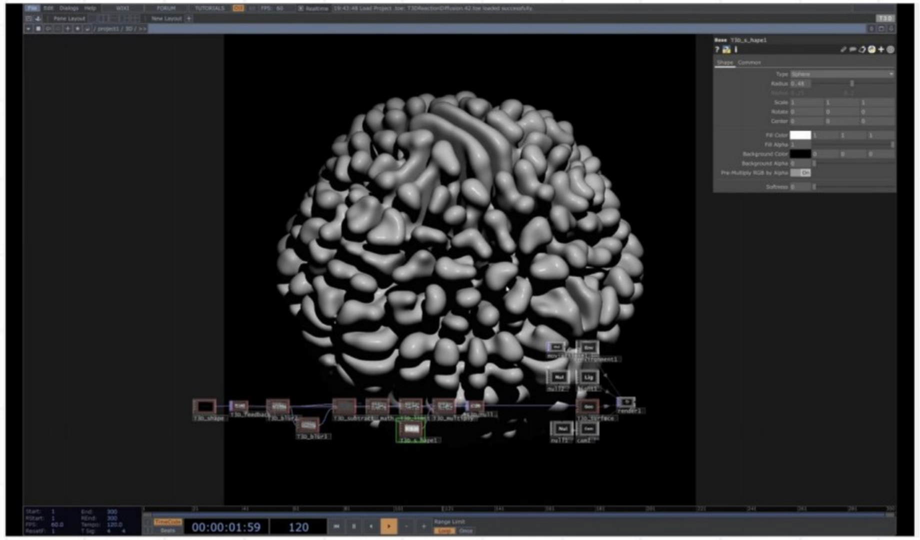
Device/Software	Function
TouchDesigner	Main control and visual generation
Kinect / Leap Motion	Audience position and gesture detection
Microphone / Audio In	Audience voice interaction
Projector / LED Screen	Visual Output
Multi-channel Audio System	Immersive environmental sound

Expected Effects

- The audience will experience the transformation of the factory's history through the combination of sound, visuals, and interaction. By engaging with changes in sound and visual elements, they will feel the shift from a bustling factory a hundred years ago to an abandoned one, and eventually to a potential future rebirth.

- The audience's interactions will create a personalized experience, triggering different sounds and visuals for each person.

- By using audio data to drive visuals, this project creates an immersive experience where sound directly affects the visuals, allowing the audience to feel the environment change through sound.



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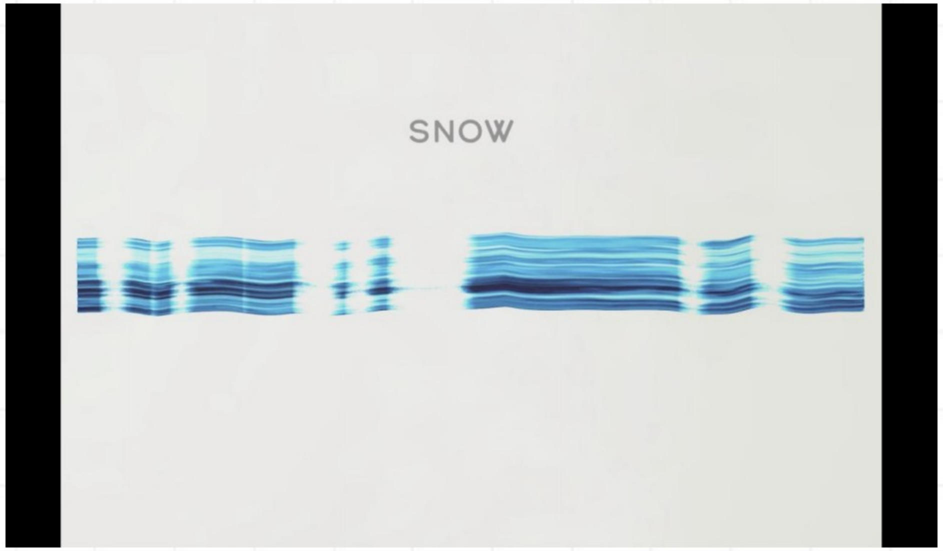

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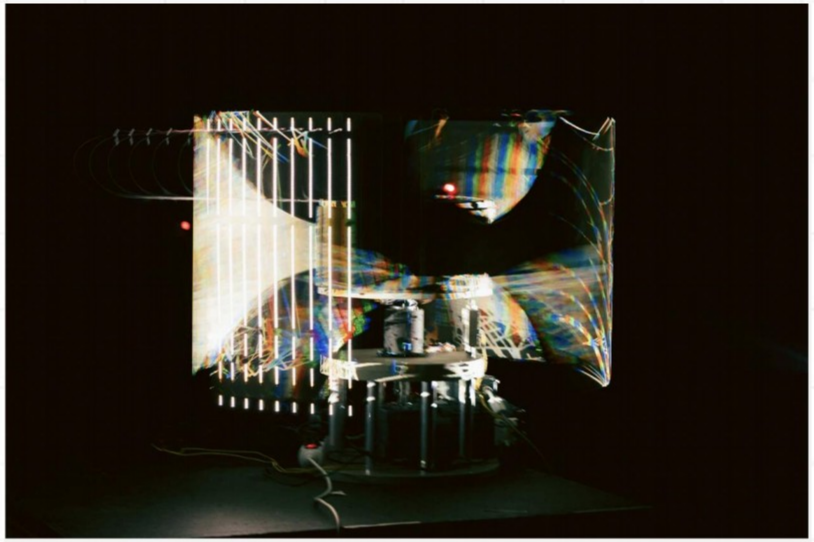

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Sound Recording/Creating & Sound Library Creation

Recording Sound with Zoom H6 & Editing with Reaper/Protools/Logic

Authors: Jieqiong Zhang, Dimple He

Design Process:

- Scene Recording Plan and Implementation
- Recording equipment and technical details
- Post-editing and sound library construction

Scene Recording Plan and Implementation

Act I: Echoes of the Past

1. Objective: To capture the roar of machinery, workers' conversations and the sound of old bells to recreate the busy scene of a paper mill in the last century.

2. Live Capture Content:

- Mechanical Sounds: Low-frequency, continuous mechanical sounds such as the operation of a large drum, the start-up of a steam engine, and the stirring of pulp.
- Vocal Conversation: Whispers among workers, discussions during shift change with noisy background.
- Cue sound effect: old bells ('ding - dong!') as a cue sound for time points.

3. Recording Devices & Settings:

- F8 Panoramic Recording Device: used to capture a 360° sound field of the entire environment of a paper mill, especially good for capturing background noise and overall ambience.
- 416 Directional Microphone: for targeting key details such as worker conversations, specific sound effects at the moment of machine start-up.

4.Recording Parameters: Adjust the gain according to the live environment to ensure that the low rumble in the distance can be captured without losing the clarity of the detailed parts.

5.Equipment Layout: Separate recording points are set up in different areas of the factory (e.g. operation rooms, near production lines, warehouse entrances) to form a multi-track recording layout.

Act I: Echoes of the Past

A hundred years ago, The Paper Factory was a world of relentless machines, operating day and night. The air was thick with the scent of pulp, massive rollers rumbled in low, steady tones, and workers moved through the sweltering, humid space, sheets of paper fluttering through the air.

Ding—Dang! The chime of an old clock rang out, signaling the shift change. Conversations intertwined, only to be interrupted by the hissing of steam from the machines. Paper was cut, stacked, and packed, ready to travel across the world. Each sheet carried the possibility of someone’ s story.

But now, these sounds exist only in memory.

As you step into the factory, echoes of the past emerge. The machines come back to life, the murmurs of workers fill the space once more, and for a moment, you feel as if you’ ve traveled back to its most glorious era.

Yet, as you venture deeper, everything begins to blur…

Scene Recording Plan and Implementation

Act II: The Empty Present

1.Objective: To create an empty atmosphere that has lost its vitality, and to demonstrate the silence and bleakness of the passage of time through ambient sound.

2.Live Capture Content:

-Spatial reverberation: the echo of footsteps in an empty corridor, the slight whistling of the wind blowing through the crumbling walls.

-Ambient details: sound of water dripping from the ceiling, low frequency hum of old equipment left over.

-Ambient Noise: recording faint noises in the environment in preparation for adding a sense of space later.

3.Recording Equipment & Settings:

-F8 Panoramic Recording: still primarily used to capture ambient sounds and reverberation effects throughout the space.

-416 Microphone: focuses on capturing detailed sounds such as water drops, footsteps and other tiny sounds.

-Auxiliary equipment: such as portable recording devices (e.g. Zoom H-series) for multi-point simultaneous recording.

-Microphone placement: Multiple microphones are set up in corridors, corners and open areas to ensure that the entire space is captured as a ‘void’.

4.Recording Techniques:

-Static Recording: Capture very subtle sound changes in the natural environment using long duration recordings.

-Background Noise Sampling: Individually captures the low-noise ‘background noise’, making it easy to build realistic sounding mix levels later.

Act II: The Empty Present

Now, all that remains is an empty shell. The machines have fallen silent, the scent of pulp has vanished, and only the wind, passing through the crumbling walls, carries faint echoes of stillness.

Walking through the once-bustling corridors, your footsteps reverberate in the emptiness. Occasionally, a drop of water falls from the ceiling, breaking the silence. The faint creak of old machinery lingers, as if whispering a mournful song of the past.

You begin to realize that this factory is no longer a place—it has become a Non-Place, a forgotten space swallowed by time.

Will its memories fade into oblivion, or are they waiting to be revived?

In this silence, your actions will determine everything.

Scene Recording Plan and Implementation

Act III: A Possible Future

1.Objective: to construct a futuristic soundscape world that is both strange and technological through post-electronic synthesis and live sampling.

2.Sound Capture and Composition:

-Live base material: metal collisions, electronic equipment noises, and mechanical parts rubbing sounds in a paper mill with potential futuristic feel were selected as the base.

-Complementary Synthesis: Using recorded ambient noise, it was deeply processed through Logic Pro and converted into futuristic electronic signals and pulsating sound effects.

3.Sound Design Objective: To let the listener experience an 'illusion of the future' in this scene - a surreal soundscape of intertwined machinery and data, technology and memories, both futuristic and faintly mysterious.

4. Post-processing and Electronic Sound Design (using Logic Pro X):

(1) Material Pre-Processing:

-Editing & Finishing: Import live recording footage in Logic Pro and edit representative clips.

-Noise Reduction Processing: Use Noise Gate and Noise Reduction plug-ins to clean up noise and retain key texture details.

(2) Time and Frequency Domain Processing:

-Equaliser (EQ): adjusts frequencies to emphasise low-frequency mechanical impulses and high-frequency electronic noise.

-Reverbs & Delays: create a blurred sense of time and space using reverb plug-ins (e.g. Space Designer) and delay effects.

-Filter & Modulation: Apply filters, Chorus and Flanger plug-ins to create unpredictable tonal variations.

Synthesis and hierarchical construction.

(3) Synthesis and layer building:mix electronic pulses and futuristic mechanical rhythms by combining live recordings with sound effects generated by synthesisers such as Alchemy or Sculpture.

-Automation Control: set up dynamic automation for individual effects to simulate irregular but rhythmic changes in a futuristic world.

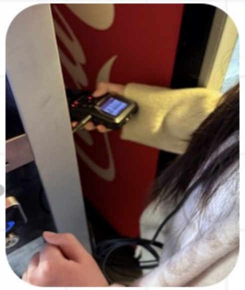
-Surround Sound Design: Use Logic's built-in surround sound mixing capabilities to distribute layers of sound effects and create an immersive experience.

(4) Detail Adjustment & Output:

-Audition and Comparison: Repeatedly monitor each level of effect to ensure a balance between electronic and mechanical sound effects.

-Final Mix: output multi-track files that meet project requirements, providing material for subsequent interactive design and re-editing.

Act III: A Possible Future



As you approach the heart of the factory, an unfamiliar sound begins to emerge. It belongs neither to the past nor the present, but to a future yet to unfold.

Electronic signals intertwine, mechanical pulses echo, and the fractured noises of broken machines reorganize themselves, constructing a world of sound that has never existed before. It could be a rebirth of the factory, transformed into something new, or merely the hollow data remnants of a place long gone.

The future of this space is no longer dictated by history—it is shaped by your perception. How you listen, how you touch, how you interact—these choices will define whether this place has a future at all.

As you reach out and gently press your hand against the wall, a sound awakens—

Is it the voice of a new beginning, or an echo of the past?

Recording Equipment and Technical Details

1. Main Recording Equipment

Classify all recorded materials (tagged by scene, setting, equipment, etc.), and perform initial editing and noise reduction in Logic Pro to ensure each sound effect meets the usage standards.

416 Directional Microphone (e.g., Sennheiser MKH416):
Purpose: Accurately captures detailed sound effects (e.g., workers' voices, machinery starting, bells, etc.).
Advantages: High directionality and interference resistance, ideal for capturing specific sounds in noisy environments.

Recording Equipment and Technical Details

1. Main Recording Equipment

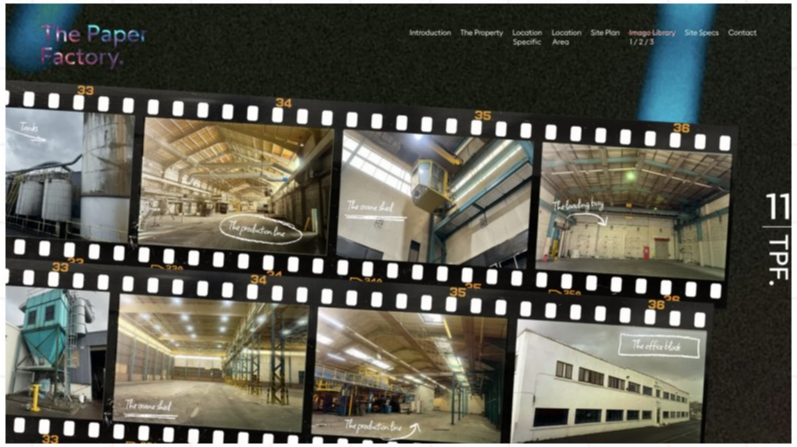
Ambisonic Microphone (Rode NT-SF1):
Purpose: Captures 3D spatial sound, providing rich material for later panoramic sound design.
Advantages: Designed specifically to capture broadcast-quality 360° surround sound, suitable for virtual reality, sound design, immersive audio, and experimental recording applications.

Contact Microphone (C-Ducer Contact Microphone):
Purpose: Captures sound by directly contacting the surface of an object, ideal for recording vibrations and sounds produced by mechanical movements.
Advantages: Capable of recording subtle vibrations that conventional microphones may not capture, such as internal machinery movements or flowing sounds in pipes.

Recording Equipment and Technical Details

2. Key Recording Techniques

On-site Dynamic Adjustment: Real-time monitoring of recordings on-site, adjusting microphone positions and recording parameters flexibly according to environmental noise and special sound effect needs.



Multi-point Arrangement: Plan recording points in advance based on the paper mill's spatial layout, creating a wide coverage and rich layered sound map.

Equipment backup and calibration: Prepare sufficient spare batteries, memory cards and windscreens to ensure that the equipment is in a stable condition; test and calibrate on site first to ensure the quality of the recordings.

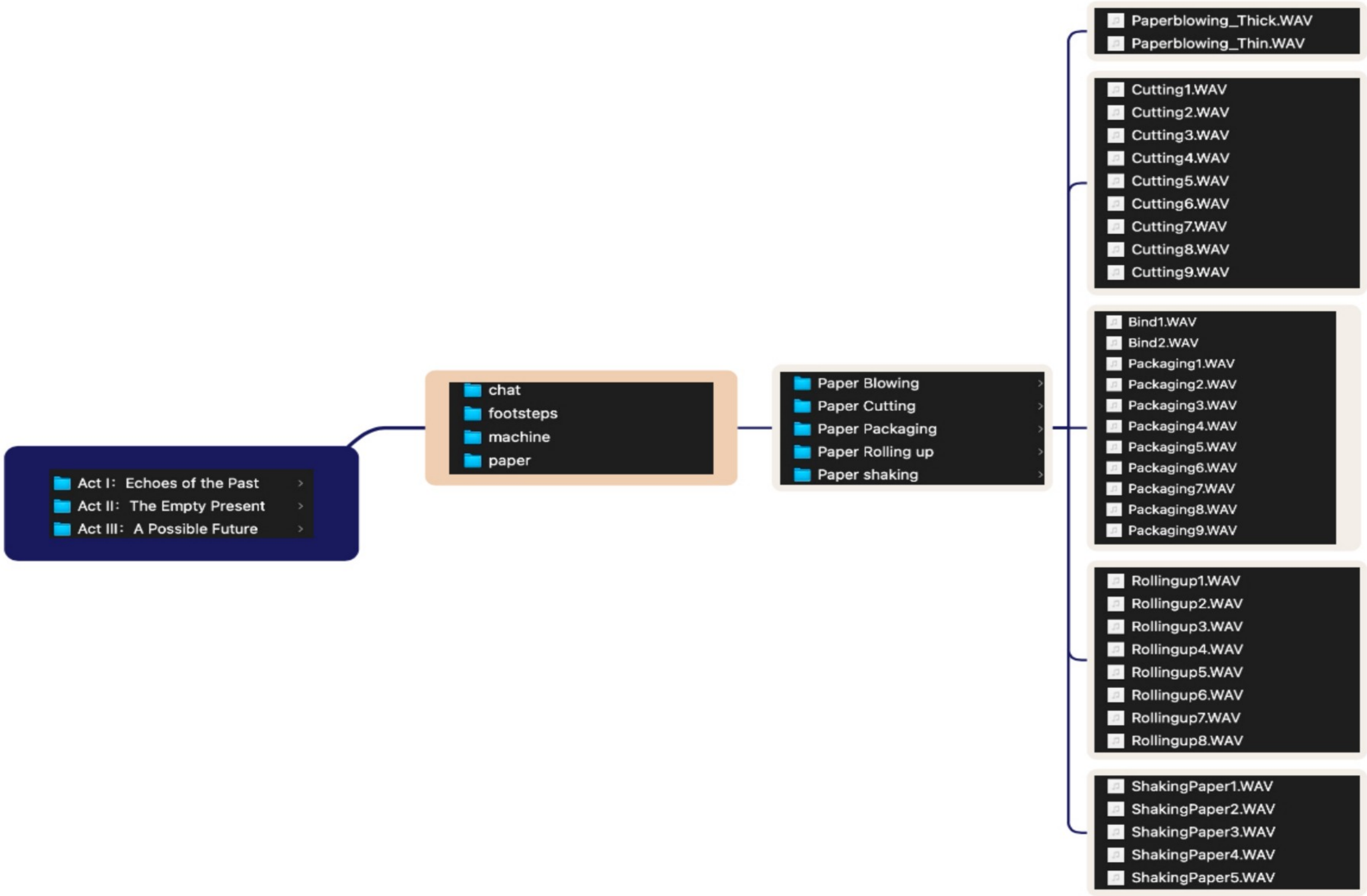
Post-Production Editing and Sound Library Construction

01 Classify all recorded materials (tagged by scene, setting, equipment, etc.), and perform initial editing and noise reduction in Logic Pro to ensure each sound effect meets the usage standards.

02 Sound Layering: Layer and edit environmental sounds, mechanical sounds, dialogue, and synthesized effects within each scene.
Timeline Marking: Mark key moments (e.g., bell ringing, footsteps echoing, electronic pulses) for reference in subsequent automation and mixing.

03 Consolidate all recorded and synthesized sound effects, storing them categorized by purpose (background, special effects, alerts, etc.), creating a sound database for easy retrieval.

Sound Library: Act I - Paper



Sound Design & Interactive Control

Exploring Sound Processing & Interaction with Max/MSP

Authors: Jingxian Li, Tianhua Yang

Project Purpose

This project aims to explore sound as a medium for spatial storytelling by processing sound with Max/MSP, utilizing interactive devices to influence sound dynamics, and ultimately achieving sound-visual integration to create an immersive experience.

In contemporary art and interactive design, sound is not just a background element but a crucial medium for shaping spatial experiences. This project utilizes Max/MSP for sound processing and integrates interactive devices, allowing the audience to influence sound dynamics through their actions, thereby creating a multidimensional immersive experience.

The goal of this project is to use sound design and interactive technology to enable space to narrate the stories of the past, present, and future, allowing the audience to experience the passage of time through their own perception.

Overview of the Sound Design Process

1

Sound Input

Capturing real environmental sounds (factory noise, wind, murmuring voices)
Using synthesized sounds to simulate futuristic soundscapes

2

Effects Processing

Echo → Creates residual sound, simulating memory reverberation
Reverb → Enhances spatial depth, making the sound more immersive
Granular Synthesis → Fragments sound, symbolizing temporal disintegration
Time Stretching → Slows down or accelerates sound, representing time distortion

3

Interactive Control

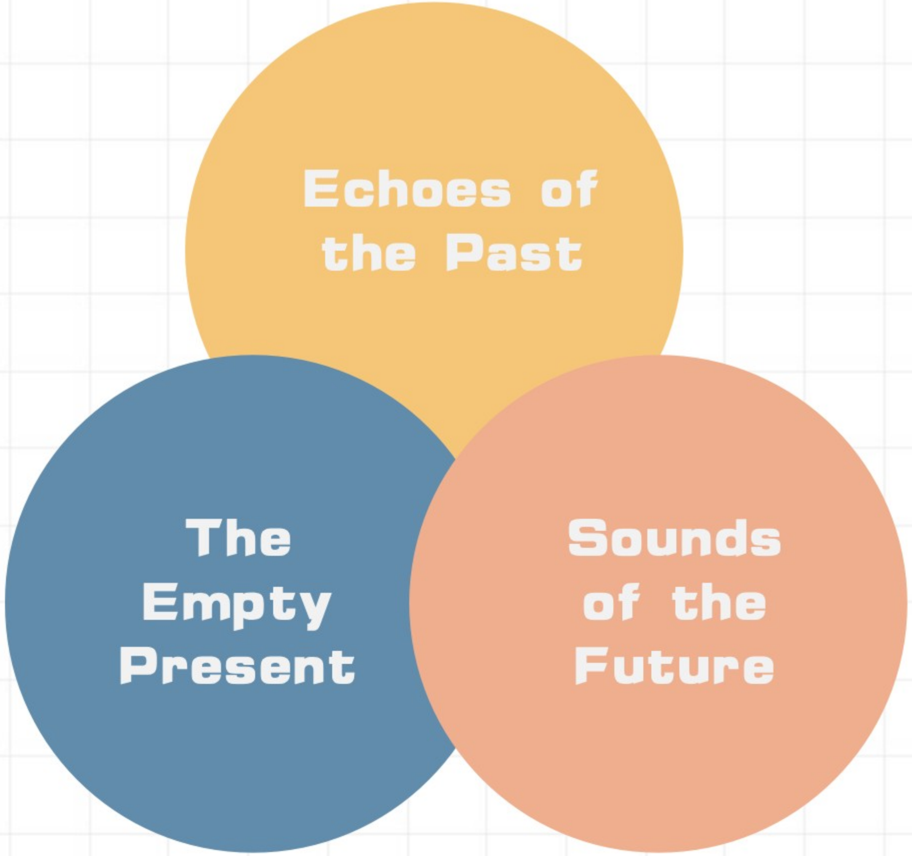
The audience's actions dynamically influence the sound, making the experience more personalized and immersive.
The interactive devices used include:
🎤 Microphone → Alters sound effects based on voice input
🖐 Leap Motion (Hand Tracking) → Allows gestures to influence sound layers and spatial perception
🏃 Kinect (Motion Sensor) → Enables audience movement to shape sound dynamics
🎛 MIDI Controller → Allows manual adjustment of sound parameters

4

Sending to Visuals (Send to TouchDesigner)

Extracts sound frequency, amplitude, and envelope data
Transmits data via OSC to TouchDesigner, enabling sound to control 3D visual models
This project follows a structured process of Sound Input → Processing → Interaction → Visual Feedback, transforming sound into a spatial memory carrier. Interactive devices dynamically influence sound behavior, and ultimately, sound data

Primary Sound Types
— Layers of Past, Present, and Future Sounds



01

Resonance of factory operations: Roaring machines, gear movements, metal friction
Residual voices of workers: Muffled speech, distant radio broadcasts, ambient noise
Echoes in space: Sounds reflecting through old architecture, forming memory traces
🎧 Auditory Experience: Reverberant and echoic, as if emerging from a distant time

02

Sparse environmental sounds: Wind passing through broken windows, dripping water echoing in silence
Subtle metallic vibrations: Creaking of shifting structures, symbolizing stagnation in time
The building’s breath: Air currents and faint low-frequency oscillations, making the space feel "alive"
🎧 Auditory Experience: Realistic but slightly reverberant, creating an immersive atmosphere

03

Electronic signal interference: Distorted tones, noise, AI-generated speech
Industrial regeneration: Future machine operations, digitized mechanical sounds
Fragments of time: Audio being warped, decomposed, and reconstructed
🎧 Auditory Experience: Granular, temporally disjointed, constantly shifting, shaping an uncertain future

Primary Sound Processing Techniques — Shaping Temporal Perception in Max/MSP

Purpose: Creates residual sound effects, simulating the auditory remnants of past memories.

🎧 **Auditory Effects:**

Causes sound to reverberate repeatedly, making it seem as if it lingers in space.Makes past sounds appear as if they are coming from a distant time.

Purpose: Enhances spatial depth, making sound more immersive and natural.

🎧 **Auditory Effects:**

Makes vast environments sound more realistic, such as wind in large spaces or dripping water. Softens dry sounds, integrating them into the acoustic space for a more immersive experience.

Purpose: Fragments sound, symbolizing the rupture and reconstruction of time.

🎧 **Auditory Effects:**

Transforms past sounds into scattered, jumpy fragments, resembling broken memories.Distorts and deconstructs future sounds, creating an AI-like, fragmented vocal texture.

Purpose: Makes future sounds more mechanical and digital or renders distant sounds more obscure.

🎧 **Auditory Effects:**

Sharpens future electronic noise, enhancing glitch and malfunction effects.Filters past sounds to make them feel like faded, distant memories.

Interactive Devices
— Enabling the Audience to Actively Influence the Sound Experience

Role of Interactive Devices

1 Enhancing Interactivity: The audience is no longer just a passive listener but an active participant in shaping the sound experience.

2 Creating a Personalized Experience: Each audience member' s actions can lead to unique variations in sound.

3 Strengthening the Perception of Time: Interaction can make past sounds feel more distant or future sounds more unstable, simulating the distortion and fluidity of time.

Primary Interaction Methods

🎤 Microphone (Voice Input)

Sound input dynamically adjusts spatial perception, enabling audience voices, noise, or even breathing to impact the auditory experience.

🖐 Leap Motion (GestureTracking)

Hand gestures control sound layers, spatial depth, or distortion, making hand movements a key factor in shaping sound variations.

🏃 Kinect (Motion Sensor)

Body movement affects the spatial distribution of sound, simulating real-world auditory perception shifts.

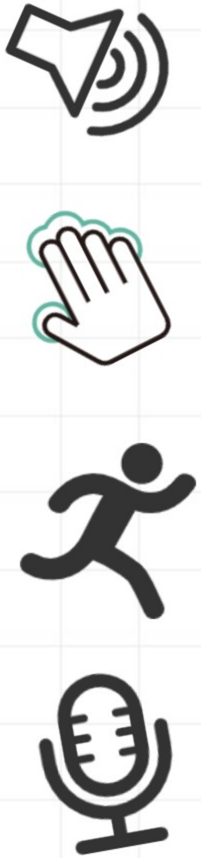
🎛 MIDI Controller

Enables manual parameter adjustments, allowing precise control over different sound layers, such as frequency, reverb, and echo.

How Interactive Devices Influence Sound

The data from these interactive devices is transmitted in real time to Max/MSP, affecting the following sound characteristics:

- Spatial Perception (Echo, Reverb) → Adjusts how sound interacts with space, creating depth and immersion.
- Temporal Flow (Time Stretching, Granular Synthesis) → Alters the speed and fragmentation of sound, simulating time distortion.
- Sound Morphology (Frequency, Filtering, Distortion) → Modifies tonal qualities, making sounds sharper, muffled, or mechanically processed.
- Dynamic Variation → Audience behavior directly influences real-time sound transformations, making each experience unique.

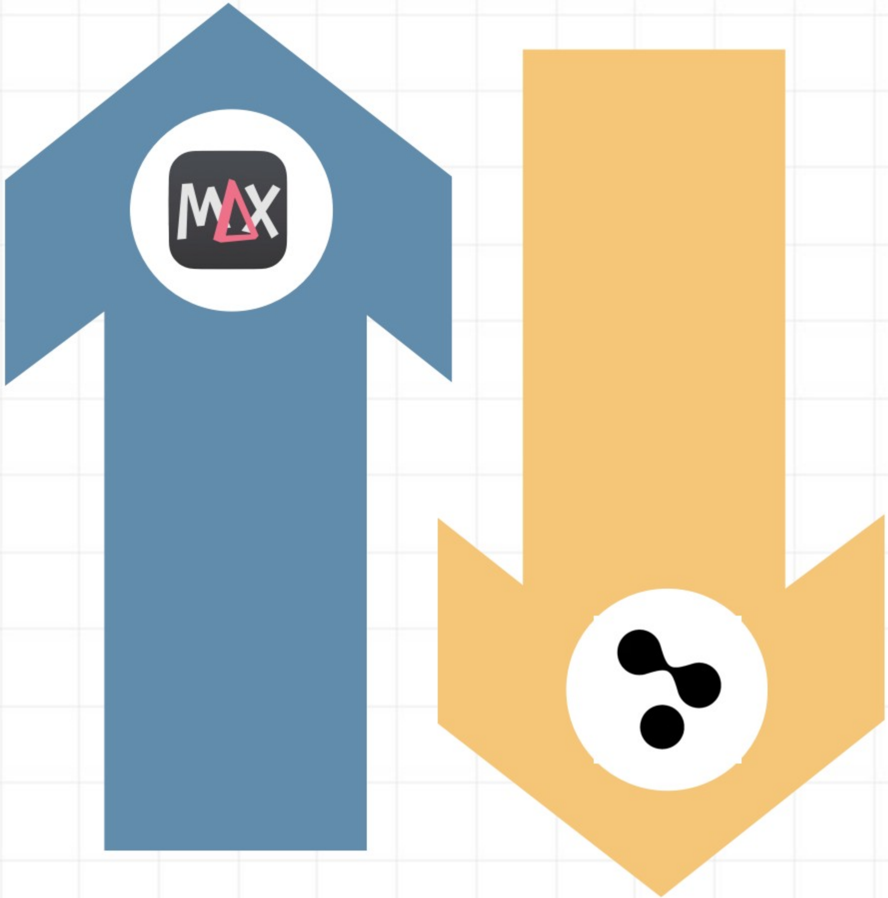


Ultimately, these sound variations are transmitted via OSC (Open Sound Control) to TouchDesigner, enabling synchronized visual changes and constructing a comprehensive sound-visual interactive experience.

Interactive devices empower the audience to actively shape the sound rather than passively listen. Through gestures, motion sensing, and voice input, participants can adjust the spatial perception, temporal flow, and dynamic characteristics of the sound. These transformations not only affect the auditory experience but also integrate seamlessly into TouchDesigner, creating a fully immersive sound-visual interaction.

Sound → Visual Synchronization
— How Sound Influences Visual Representation in TouchDesigner

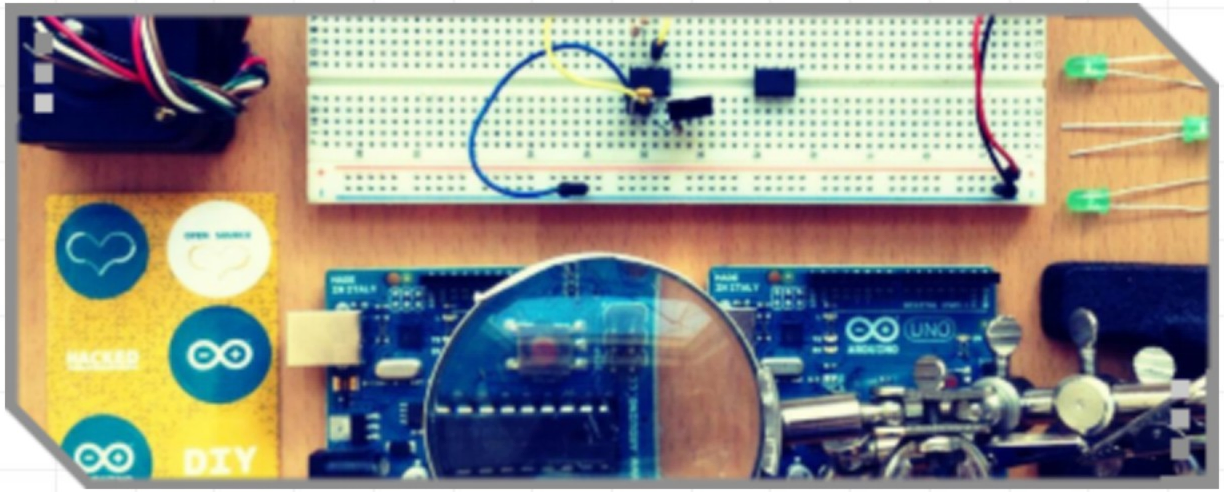
In this project, sound is not just an auditory experience but also a key driver of visual transformations, creating an immersive audio-visual interactive experience. We process sound in Max/MSP and utilize OSC (Open Sound Control) protocol to transmit essential sound parameters to TouchDesigner, enabling 3D visual models to dynamically respond to sound variations.



Sound is not just an auditory experience; it also directly controls visual elements, enhancing immersion. Max/MSP transmits sound data via OSC, influencing 3D visual models in TouchDesigner.

Audience interaction → Modifies sound → Affects visuals, creating a truly multidimensional immersive experience.

https://www.ultraleap.com/leap-motion-controller-overview/



https://www.ada-x.org/en/activities/interactive-installation-training-arduino-maxmspjitter/

https://www.wired.com/2012/01/microsoft-bets-kinect-windows/

Visual Data Acquisition & Lidar Scanning

Scanning visual data via Leica BLK360

Authors: Yuheng Ren

Introduction: Why Will LiDAR Be Used in This Project?

To create The Paper Factory installation, we will need a precise and dynamic digital recreation of its physical space. Traditional 3D modeling methods can be slow and imprecise, but LiDAR scanning will allow us to capture the environment quickly and accurately.

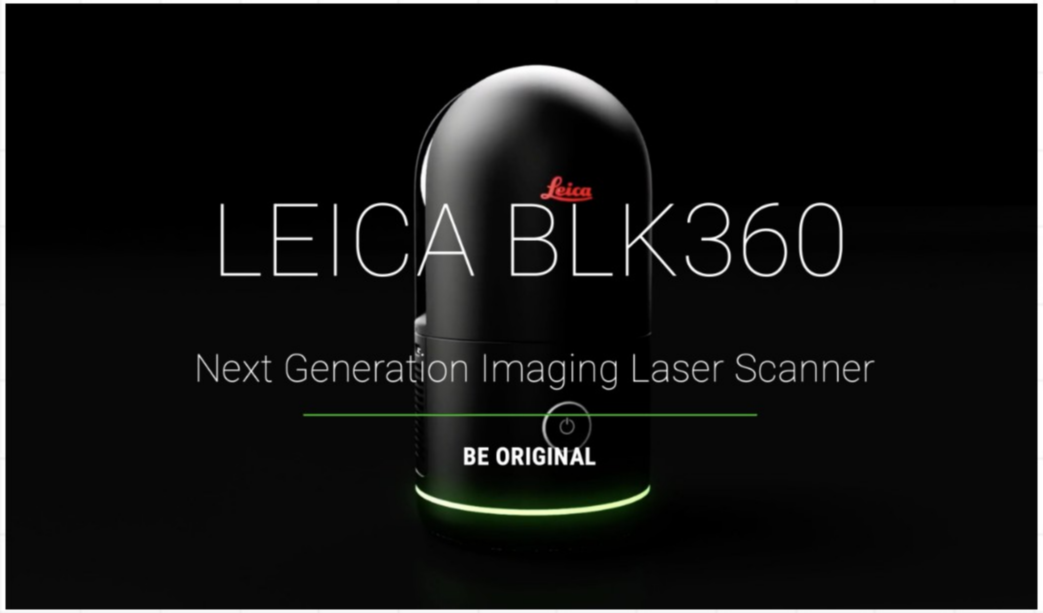
Using the Leica BLK360 LiDAR scanner, we will:

✅ Digitally reconstruct the abandoned paper factory with millimeter accuracy.

✅ Generate a realistic 3D point cloud, which will be the foundation of the interactive visuals.

✅ Enable real-time interaction between sound, audience movement, and visual elements in TouchDesigner.

This technology will bridge the gap between the physical space and the digital world, allowing sound to dynamically reshape the environment.



How Will the Leica BLK360 Capture the Factory?

📍 Step 1: Scanning the Space

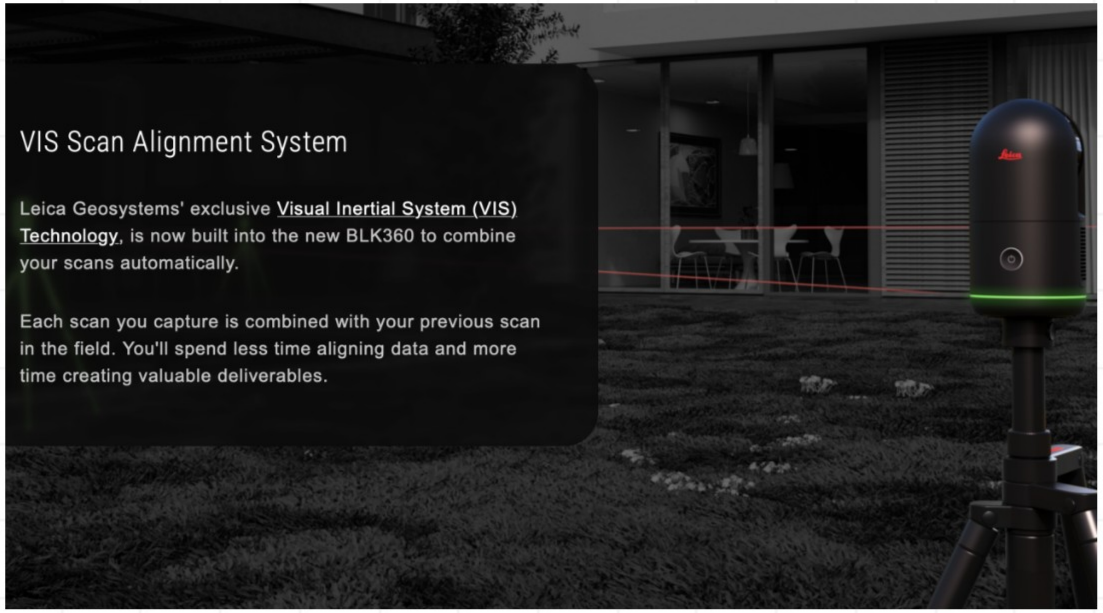
The Leica BLK360 will be placed in different locations within the factory.
It will emit thousands of laser beams per second, measuring distances to surrounding surfaces.
Each scanned point will be saved as a "point cloud", forming a detailed 3D map of the environment.

📍 Step 2: Processing the Data

The raw point cloud data will be cleaned and optimized using Autodesk Recap or CloudCompare.
Any unnecessary noise will be removed, leaving only the essential structure of the factory.
The final model will be converted into E57, PLY, or OBJ formats, making it compatible with TouchDesigner.

📍 Step 3: Importing into TouchDesigner

The 3D point cloud will be loaded into TouchDesigner's Point File In SOP.
This will allow real-time manipulation of the factory's digital replica.
At this stage, the visuals will be ready to respond to sound and audience interaction.



🔷 How Will LiDAR Data Connect to Sound & OSC in TouchDesigner?

1Once the factory’ s digital model is created, we will make it interactive using sound-driven transformations.

🔗 The Process Will Work Like This:

1 LiDAR scanning will capture the physical space → This will provide the 3D foundation of the installation.

2 OSC (Open Sound Control) will transmit sound data → This will allow audio signals to influence visuals in real time.

3 Sound will dynamically reshape the LiDAR-based 3D visuals → The audience will see how sound distorts, animates, and transforms the space.

For example, as participants move through the digital factory, whispers of workers, the hum of machines, and rustling paper sounds will directly alter the environment.

What we expected to acheive?

✅ LiDAR will provide the space → A high-accuracy digital twin of the factory.

✅ OSC will connect sound to visuals → Making the factory react to sound in real time.

✅ TouchDesigner will transform everything → Creating a dynamic, interactive experience.

✅ The audience will bring it to life → Through sound, movement, and participation.

This project will not just recreate the past—it will allow the past, present, and future to coexist in real time, driven by sound and interaction.

Project Summary

In this project, we utilize Max/MSP for sound processing, integrate interactive devices to allow the audience to actively influence sound dynamics, and ultimately transmit sound data via OSC to transform it into dynamic visual effects in TouchDesigner, achieving a fully immersive sound-visual interaction.

🔷 Sound Design → Shapes layers of past, present, and future through echo, reverb, time stretching, and other techniques.
🔷 Interactive Control → Enables the audience to dynamically alter sound using microphones, gesture tracking, motion sensing, and MIDI devices.
🔷 Sound-Visual Synchronization → Uses OSC to allow sound to drive 3D visual transformations in TouchDesigner.

Final Objective
To create an immersive artistic experience based on sound, interaction, and visual transformation, allowing the audience to explore the flow of time and the remnants of memory on a multi-sensory level.