Future of Greens

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1. Project description

Keywords: Nature, Industrialization, Technology, Artificial Nature, Multimedia Installation

Future of Greens is an exploration of how nature would develop in the anthropocene, where humans are altering nature more than any other creature on earth has. With rapid urbanization and industrialization we are losing nature and the natural laws that sustain the earth. Human intervention has changed the climate, population of different plants and animals, and the ecosystem which is in turn affecting humans. As we lose contact with what used to be nature, we are creating new ways to replace it with new technologies, from genome editing to creation of artificial and digital nature. *Future of Greens* visualizes these artificial alternatives to the rapidly decreasing natural environment, questioning what would be the next nature. It consists of two parts: 1) a virtual environment that is a hybrid of nature and mechanics 2) physical installation that recreates the form and sound of a traditional natural environment with industrial materials.

2. Research

"Global Urbanization and the Separation of Humans from Nature" by Will R. Turner, et al. assesses that former literature on how urbanization has depressed biodiversity fall short in quantifying the issue in a citywide or human-wide scope. The authors looked into the question of "whether, and to what global extent, urban humans are in fact displaced relative to biological diversity (Turner et al. 1)" by using quantitative data and research methods. By analyzing various data such as urban species distribution and population in different neighborhoods in different cities, the essay arrived at the conclusion that urbanization has done great harm to biodiversity, and former findings might have underestimated the effect. This essay provides evidence for the basis of *Future of Greens*: urbanization is indeed doing harm to nature and therefore it's significant to put forward this concerning phenomenon. Together with the fact that the massive use of machines is one of the most iconic symbols of modern urbanization, it is intuitive to use mechanics to symbolize urbanization and human manipulation in comparison to nature.

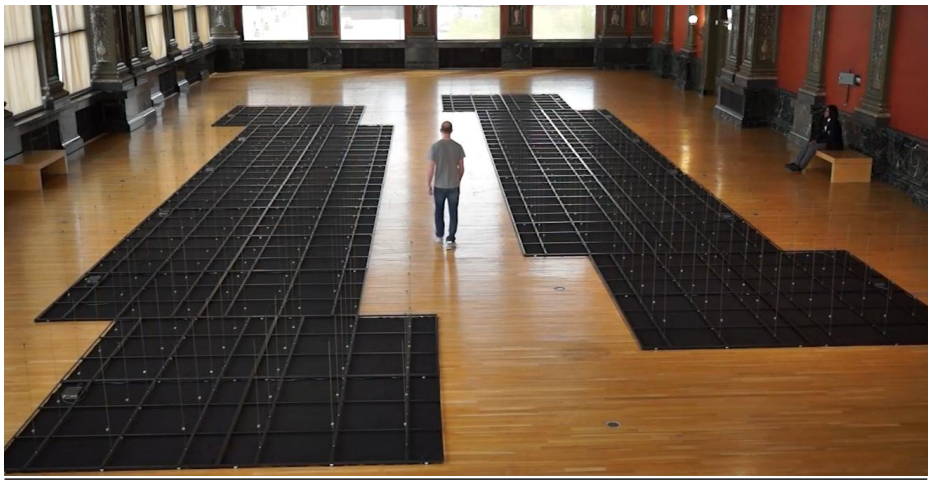
To successfully articulate this idea, we have chosen the form of sound installation for the physical part. Development of contemporary art has been focused mostly on visual arts. However, a story that an artist can deliver through an installation goes beyond merely the visual impact. Rocha explains that "the experience of the artistic visual work is modified completely when we use sound as an integral element" (2). By adding sound, the aspect of time is added to the spatial and dimensional characteristics of the installation. This is why Bandt summarizes sound installation as "as a place, which has been articulated spatially with sounding elements for the purpose of listening over a long time span" (353). A sound

installation “dissolv[es] the boundaries articulated by all other fine and musical arts” through creating connection between the eyes and the ears, the haptic and the spatial, the temporal and repeated, providing a truly immersive experience to the audience (Bandt 354).

Existing sound installations that focus on the creation of sound through mechanized processes provides some guidance for the physical execution.

As indicated by its name, *40 Prepared AC-Motors, 93 Kg Paper Black* by Zimoun is made of ac-motors, black paper, wood, metal, and nylon. Zimoun laid black paper on top of the motors, shaping the paper into a form of a concrete “ocean”. He then used ac-motors to create the motion of moving the paper portion by portion, which made the paper move against each other and ultimately create sound. Because of the material he chose, the installation sounds like rain. Thus, what makes this artwork so successful is his choice of material that creates the sound, and more importantly, the idea of using the motion of particular interaction between materials to make the sound that simulates nature. This piece inspired us a lot in terms of using non-nature materials to simulate sounds of nature, which in our case leans more towards industrialized mechanics to simulate the sounds in nature. Thus, in our project, we intend to borrow his idea of simulating sounds in nature with non-nature materials.

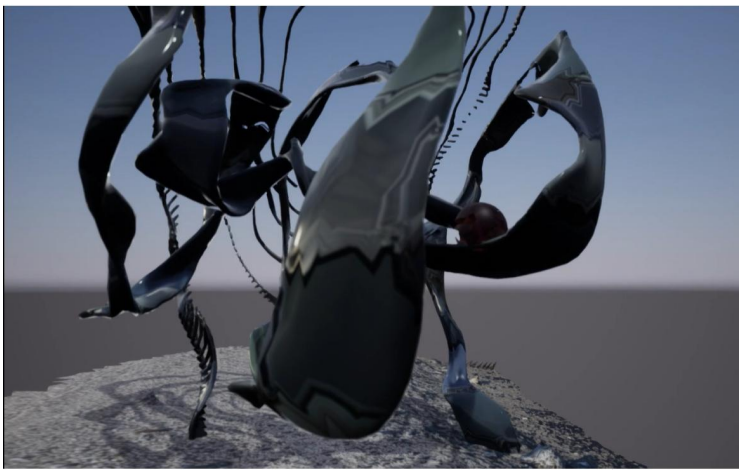
R x2 is a kinetic sound sculpture sonifying data collected on the power and depth of shocks in earth's crust above 0.1. The data is converted into the sound of acoustic drums using motors depending on the intensity of the earthquake. The motors move the spring attached to the skin of the drums, creating a continuous resonance when shaken by the motor. The resulting sound resembles that of a natural disaster like a thunder or an earthquake. While it is an effective data visualization, as our installation is not based on data, we would need to design the trigger and the process without such concrete basis.



This piece mimics the ecosystem of grasslands with the soundscape of insects, rain, wind and other environmental sounds while visually recreating grasses flowing with the wind. The curator of this work, Lanny Silverman, explains that it is a perfect example of how "the interplay between nature and the machine, human intervention and artifice is complex and multi-layered". It consists of brass rods vertically mounted to a vibration motor at the bottom and speaker at the top, which makes the rod sway with the sound like a real grass. The neighboring rods are affected by the movement of one, simulating the collective movement of grass. This work is very similar to what we want to achieve, using mechanical components and simulating both the sound and the form of natural reference. We would be designing a work that expands this into using more diverse industrial materials that has a direct metaphor to urbanization and human interference in nature.

On the other hand, in the virtual space, we can extend the imagination beyond what is possible in the physical realm. The article "Mechanical Trees To Be Used For Carbon Capture" points out that with the development of economy and industry, and the improvement of people's living standard, carbon emission will be increasing to new heights and become more difficult to control. Klaus Lackner from Arizona State University points out that fighting climate change will take more than limiting the planet's CO2 emissions. Instead, removing existing carbon from the atmosphere has become a necessity with the help of direct air capture through the high efficiency mechanical tree. The scientists predict that in the next 20 years, mechanical trees are to become just about as common as cars. Mechanic trees to absorb carbon in the future are already imagined, so we want to go one step further to build a creature that symbolizes how people's nostalgia of plants can evolve into. The combination of metal, steel, and concrete as well as different kinds of greens and flowers shows a possible texture of the future, with our developed technology and people's reminiscence to the real greens in nature. We will also add the

breathing motion to our creature, to show that it's absorbing carbon as well as showing the breathing and soft feeling of nature.



The VR artwork by artist Jakob Kudsk Steenen inspired us with its floating and breathing feeling of movement. Though the body structure of the artwork is not related to nature and has no element that can be linked with nature, its movement of floating, stretching and fading gives us a feeling that the artist is using it to describe the softness and gentle of the nature, like the plants growing and wither, floating in the wind. In the middle of the main body there is a spherical object, like the beating heart of nature.

The Sculpture Falling Sun made by Mihaela Kamenova, is deeply inspired by the symbol of the sun and its fire. It depicts a falling rolling sun, and shows its dynamics and action. The separated lines show a tendency of the gradual dissipation of the power. The dispersion of the sun indicates that most of the sun's power has already been used up. This inspired us to also show an "artificial sun" created by the

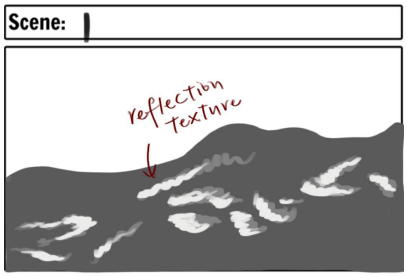
future human beings that they would take energy from in our project. Because in the future humans exploit nature more and create such manmade sun-like creatures to store and produce energy.

3. Sketches

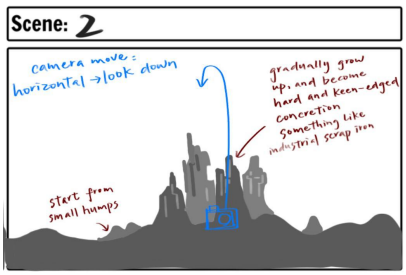
a. Virtual

i. Design & sketches

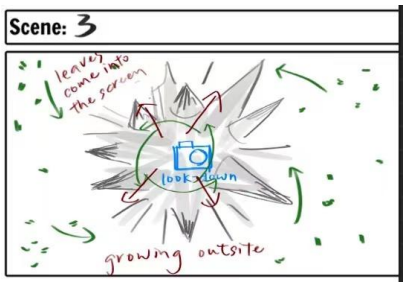
The storyboard of our design is as follows.



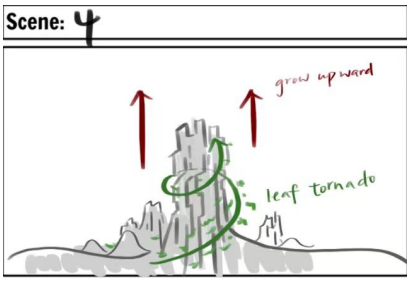
At the beginning, there will be a kind of silver colored liquid thing with a reflection texture in the scene. The melting steel-like material represents the future of the world which is made of steel and concrete. The overall environment gives people a depressing and dark feeling, foreshadowing the future of human beings living in a world of technology and industry, without the breath of nature and green.



The second scene represents the rise of the city. The silvery-gray liquid first raised upward like a small humps, and then slowly solidified to form a hard and keen-edged concretion like the industrial scrap iron.

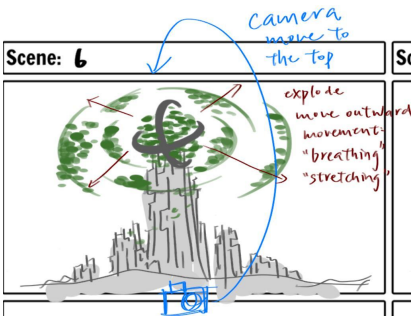


The camera will move from the horizontal view to the top view to look down to this structure. When looking down, the viewer could see many hard-edges growing upward. The camera will also move upward together with the growing concretions. After a while, there will be leaves coming around, flying and tangling between steel and concrete. This means that nature still exists and is developing together with the city.

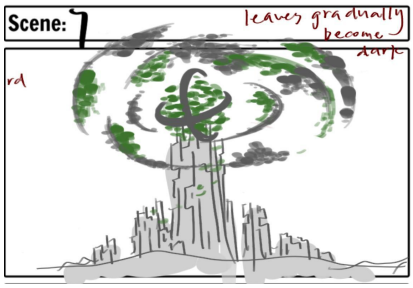


In scene 4, the camera goes back to the horizontal view. As the tower-like “city” of iron and steel grows up, the leaves develop together with the city as a form of the leaf tornado.

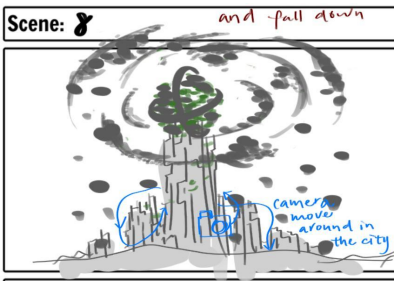
When the leaf tornadoes reach the top of the city, they become controlled by humans. Heman beings cause pollution, disafforestation, and developing their technology and industry regardless of what nature has suffered. The leaves are wrapped within iron rings, which shows that people’s behavior has put on the fetter to nature, and nature was in a state of imprisonment and exploitation. The leaves in the iron ring are beating like a heart. It shows the faint breath of nature under the ravages of humans.



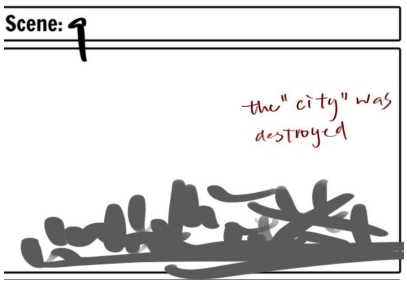
The leaves on the top of the “city” “explode” into the umbrella-like or sun-like thing. It expands outward, with the movement of floating, breathing, and stretching, which represents the soft and gentle feeling that nature gives us. The camera will move from horizontal to vertical, looking down to the rotating leaves sun.



The leaves gradually turn dark, turning to the color of iron and steel. They are no longer light leaves flying in the air, but become heavy, and their color is no longer green and lustrous, but gray like that of the “city”.



The leaves gradually fall down and smash the city. It means that nature is destroyed by human industry and pollution that is caused by urbanization. At the same time nature is destroyed, the human city is destroyed at the same time, because nature is an essential part of human activities. The camera moves inside the “city”, moving through “buildings” and “buildings”.



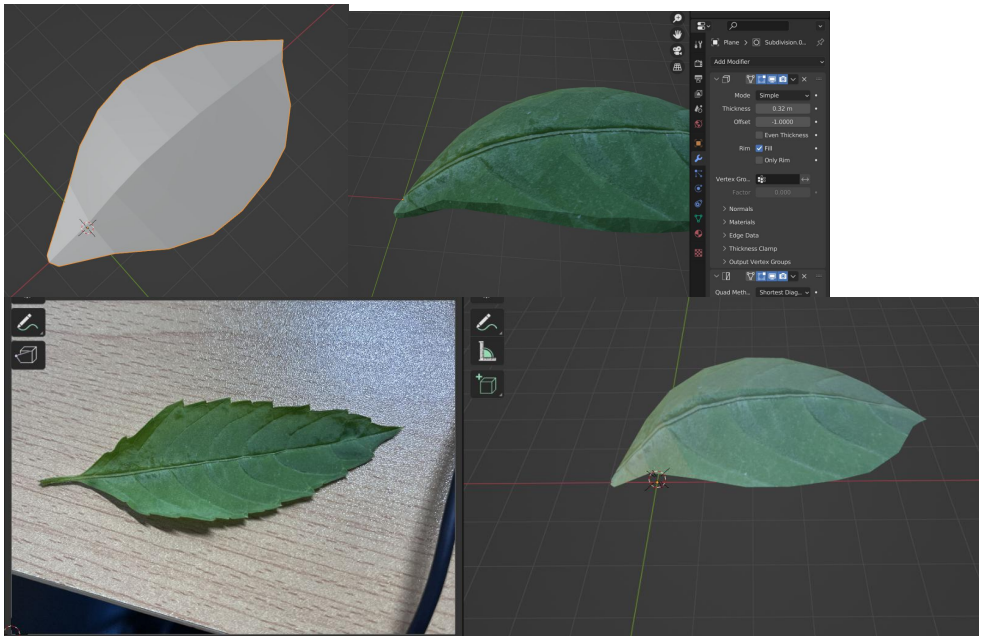
The city was destroyed. They go back to the form of liquid at the beginning. Forborading that the human civilization has vanished, and there are infinite possibilities for the future civilization.

ii. Models and Materials:

1. Apply Photogrammetry to get the 3D model of some realistic objects that indicates the nature and industrial society. And we look for the materials with nature and metal elements.
2. Make the photogrammetry models dispersed to have multiple incomplete models. Put the photogrammetry models in certain positions to form specific shapes. Combine the objects of nature and industrial elements to create a new creature that can fly and move.
3. For the models and shape we cannot make with photogrammetry or directly using geometries in unity, we would get the asset from unity asset store or other approachable assets.

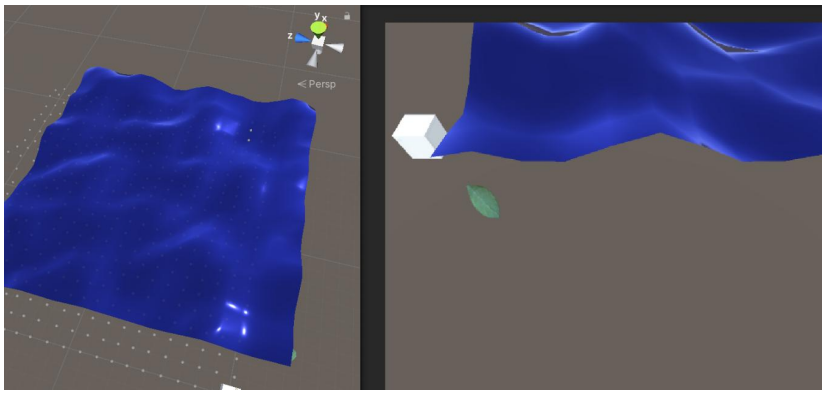
iv. Development

1. Leaf Modeling thorough Blender



We first used blender to make a model for the leaf needed in our scene in Unity. We took a picture of the real leaf and used it as the texture for the leaf model.

2. Mesh Terrain Generator

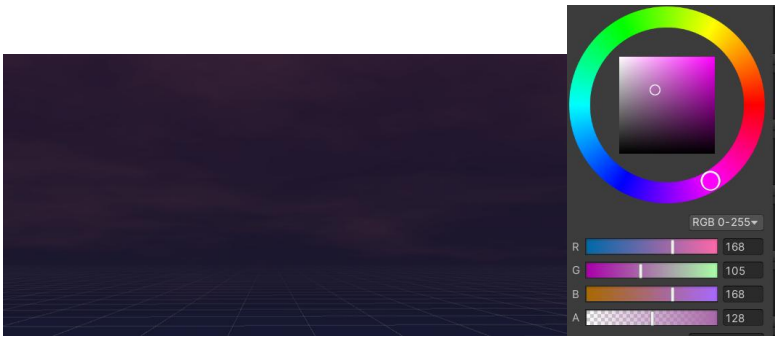


We built a flowing terrain as the surface of the ground. In the script, we first created a grid of vertices through an array, then filled in the grid with triangles, and finally used perlin noise to adjust the height of every vertex. We gave it a dark blue color as its texture. We also built another mesh for the growing part using the same method.

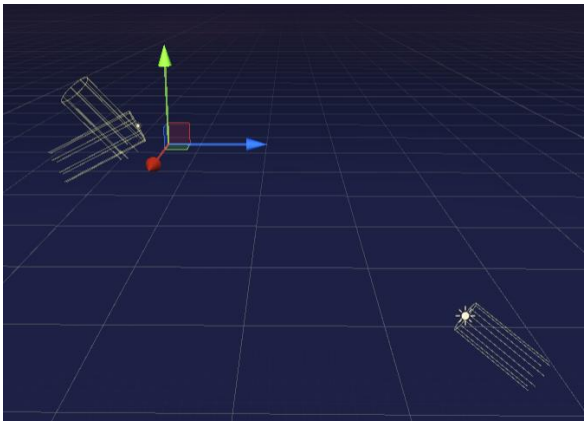
Reference: https://www.youtube.com/watch?v=64NblGkAabk

3. Lighting Adjustment and Sky Box

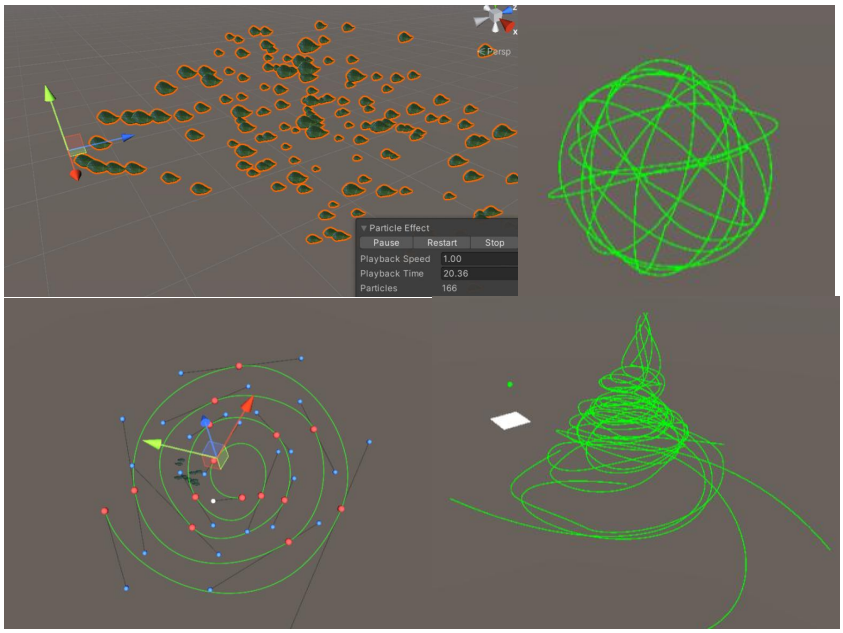
We used the skybox with sky and cloud and star from an asset package posted on unity asset store. https://assetstore.unity.com/packages/2d/textures-materials/sky/colorskies-91541



And we adjusted the color tint into purple to create the post-apocalyptic atmosphere. However, the overall lighting of the atmosphere was too dark, so we added three directional lights with different rotation angles to light up the main body. Two directional lights lighting up the ocean-like terrain sets the atmosphere, and one of them lights up the city growing in the middle of the whole scene.



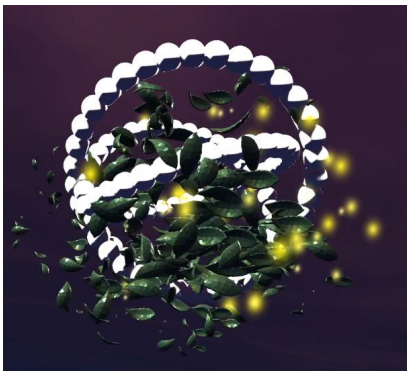
4. Leaf Particle System with Different Motions though Path

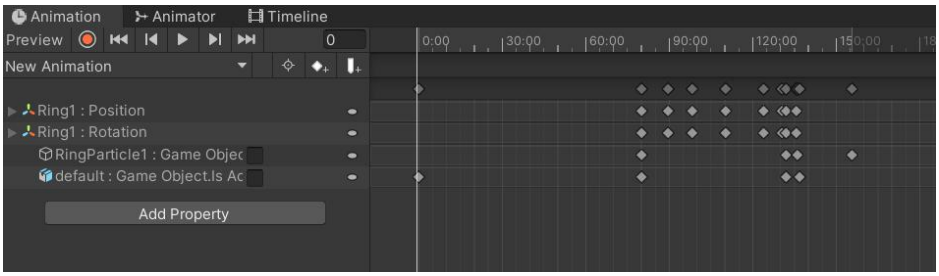


We used a particle system to generate the leaves. To make them move in a specific direction, we used a bezier curve to create paths for the leaves to flow. Through this method, we made the tornado, the ball, and the leaves of the sun.

5. Object Animation and Vanishing Effect with Particle System

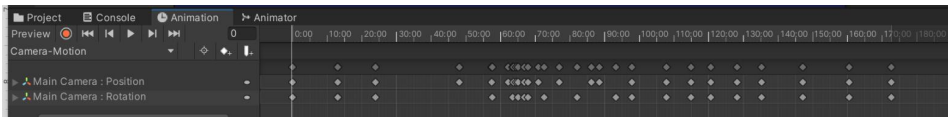
   We created transform animations to the rings to make the rings on the top to rotate with time.





When a certain amount of time is reached, the rings gradually disappear and the particle system game object is set active, and it begins to dissolve into small particles, gradually falling down and disappearing with the size shrinking with time. We made this by setting the particle system shape into the “Mesh” shape, so that it fits the shape of the rings, and would be as if it is dissolved from the ring.

6. Camera Movement



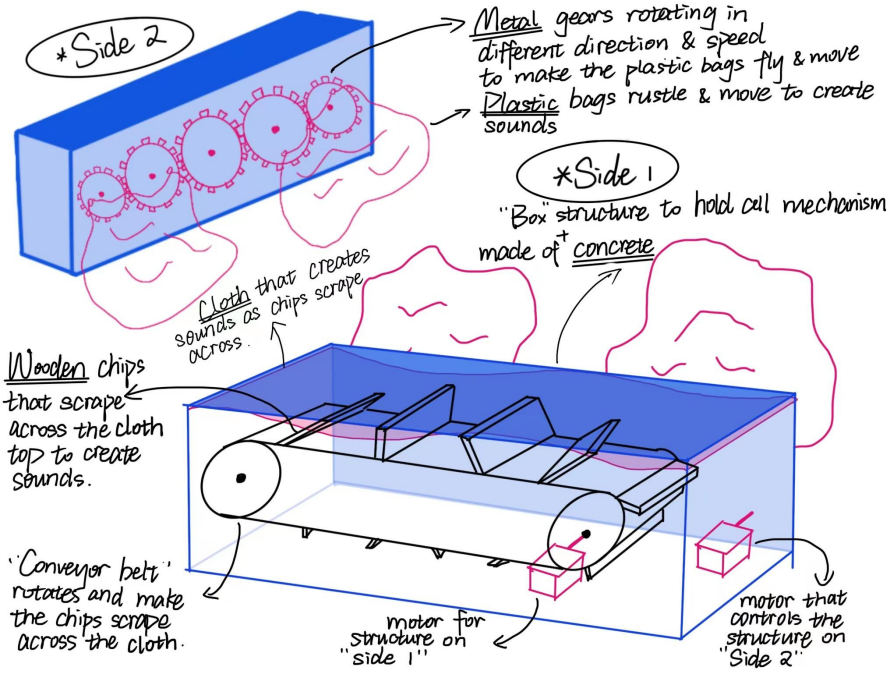
We added camera movement to better show the scene and its developmental process. We used multiple camera angles to explore a more diverse view of the scene. There are also some dramatic points in the video that the camera collides with the mesh, goes under the water, or goes inside the ball of leaves, making the video more interesting.

7. Audio Effect

We downloaded multiple audio sources from the FreeSound website, including the background music composed of a peaceful drone, soft wind and breeze, and growing bulbous noise (working as the growing sound of the mesh), sound of underwater, glass breaking and tree leaves rustling. We modified the audio’s speed and pitch to better fit in our animation. The main music has a dark and low sound, giving us the feeling of a dilapidated city in the future. The main sound of the leaves rustling is the sound made by the physical sculpture artists.

b. Physical

i. Block design

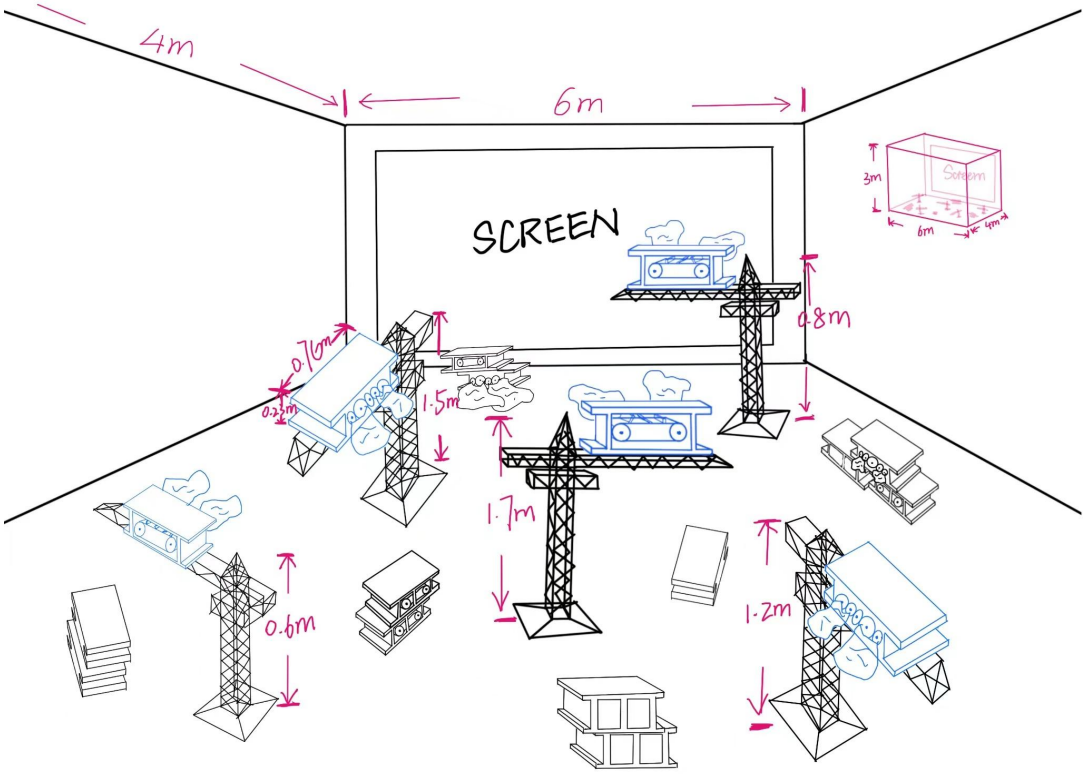


The sculpture consists of two parts: 1) a conveyor belt with extruding panels inside a cement block 2) two plastic bags rustled by five gears attached to the back of the block. These two parts together create sounds that mimic wind blowing through a forest. The outer structure of the block is a reference to a cement block, a frequently visible component at any construction site. The ceiling of the block is a fabric creating sound with the system described below.

On one side, there is a conveyor belt operated by a stepper motor and two cylinders. The panels extruding from the belt scrape across the fabric on top to generate sounds. The panels are designed with different angles and length to add more texture, variation, and layers to the sound.

On the other side, there is a gear train with multiple gears of different sizes. The gear train is attached to the back of the block and activated by a stepper motor inside of the block. The gears move the plastic bags attached to it, creating movement and rustling sound. Because the gears turn in different directions and speed, the movement of the plastic bags are given a characteristic of randomness which ultimately adds variation to the auditory result.

ii. Installation plan



The installation space is rectangular of 4m * 6m size. The virtual environment would be projected at the farthest end. The concrete blocks would be placed on tower cranes of different heights, diversifying how close the audience would be accessing the sound. The format is a metaphor of trees composing a forest, with several sculptures on the floor as bushes and grass.

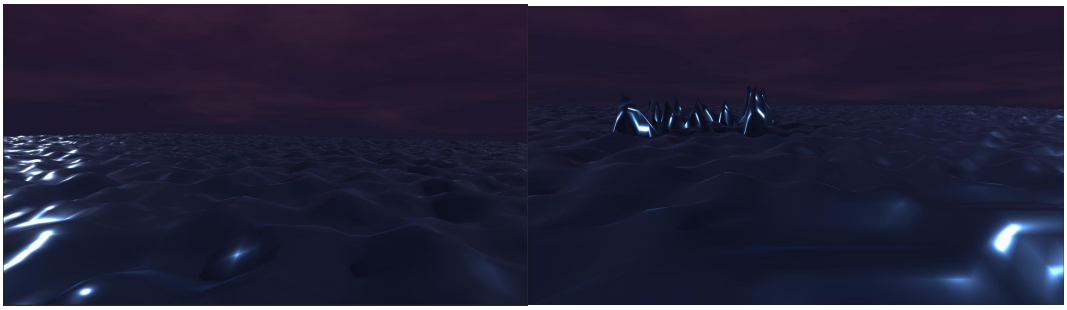
2. Samples

a. Virtual

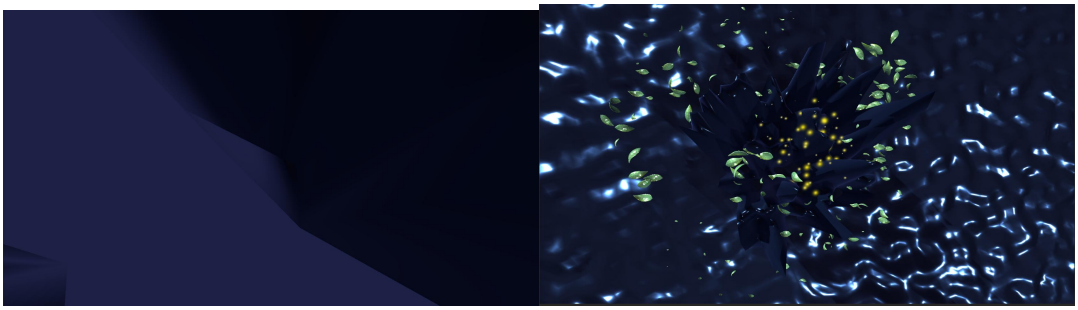
Video: [Future of Greens -- Immersive Arts Final Project - YouTube]

GitHub page: [Sissytttt/IA-Final-Project (github.com)]

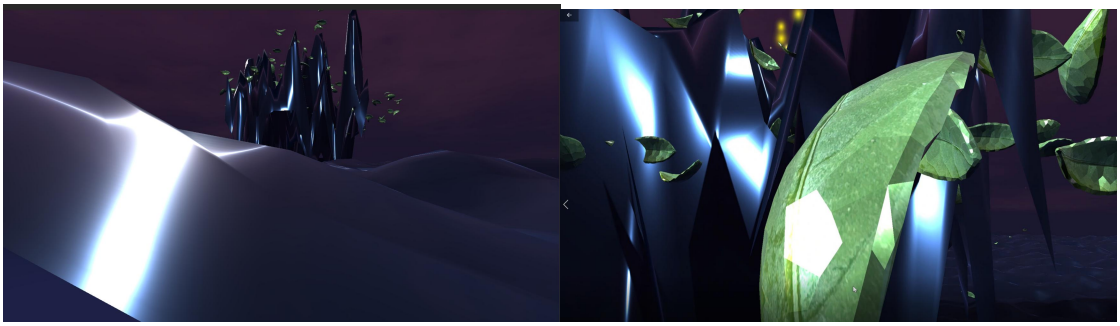
The sequence is the same as the storyboard.



The first scene is the surface of the broad and dark flowing liquid. The camera moved around to show the viewers the whole scene, and stopped to observe the growing metal fluid.



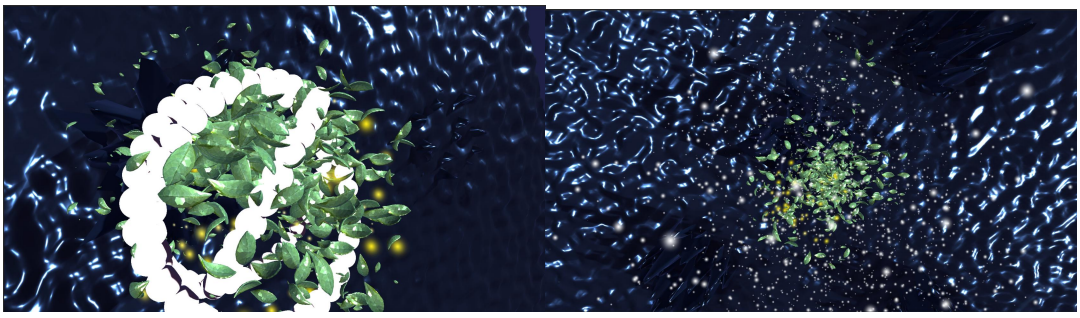
The camera moves up to give a top-down view of the growing structure. The leaves started to float in, circling between the structures. The camera rotates and moves upward, and suddenly dive into the liquid.



Some special camera angles are presented in these two pictures. One is inside the structure, with leaves close to the camera; and another is floating on the surface of the camera, floating on and down the liquid.

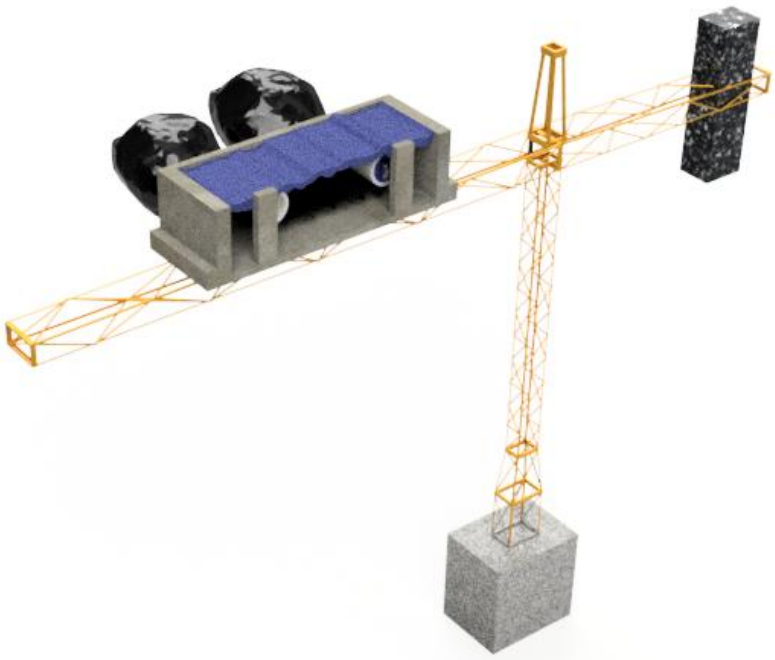
Then, the camera shows an overview of the general scene: there is a ball on the top of the structure, rotating and constraining the leaves inside of it. The leaves inside are also rotating quickly, as if trying to break free from the shackles.

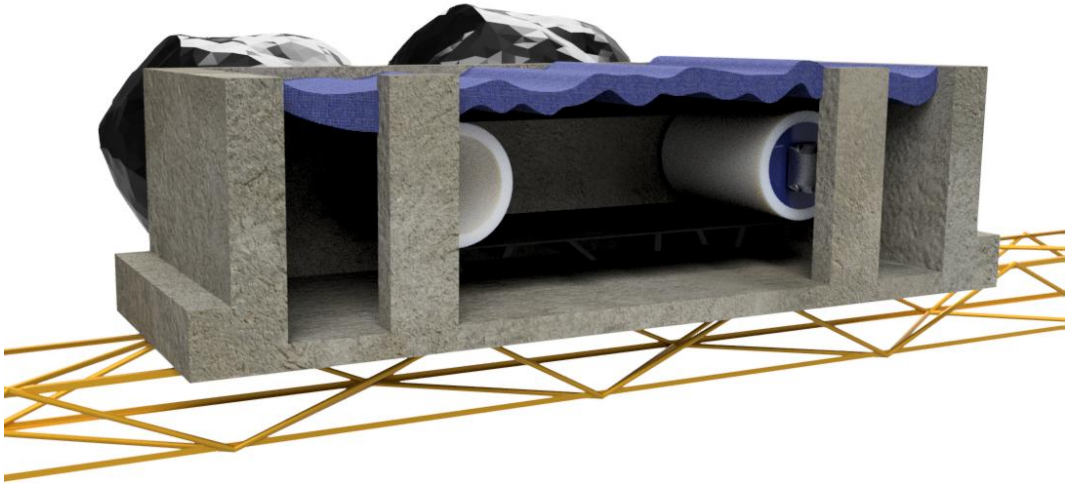
The reference of the ring: https://www.cgtrader.com/free-3d-print-models/jewelry/rings/free-ring-e9c25727-c480-4430-b24f-c57a73da4e74

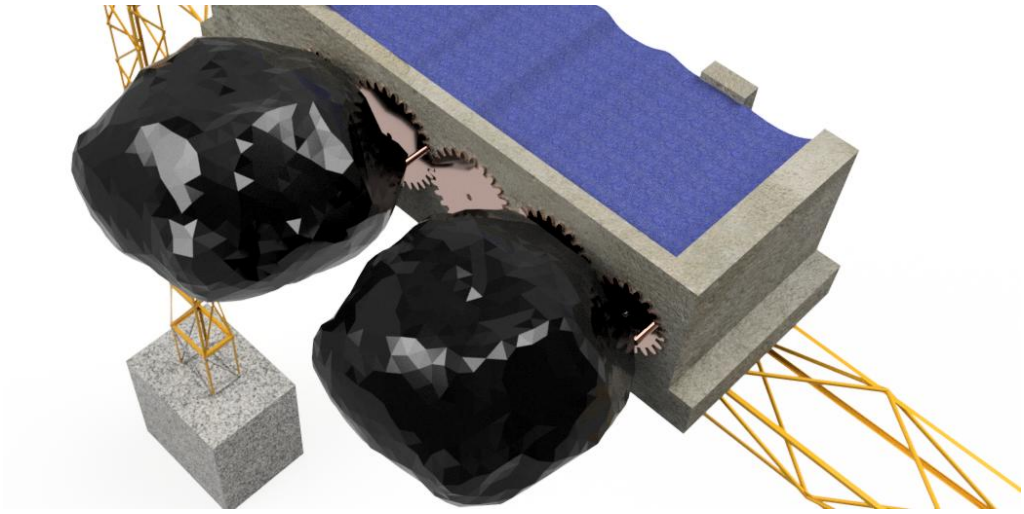


The camera moves through the ball, showing a close look of the leaves inside, and then goes to the top down view to look down at the whole thing. All of a sudden, the ring was broken, and the leaves came outside, and expanded while rotating.

b. Physical
    i. Sculpture







ii. Sound

The sound we're creating is the sound of wind blowing through the forest, in order to correspond with the scene that the Immersive Art part is making. This audio is a demo of the sound that we intend to generate with the sculpture. The sounds are generated by rustling plastic bags of different textures and wood and cardboard scraping across fabric.

3. Bibliography

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