

Eito Murakami

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Becoming - Sonic Arts Research and Development



Artist Statement

Becoming is a virtual reality composition based on a Persian poem by Mowlana Rumi. The piece explores the evolution of organic elements on Earth. The main feature of the piece is the implementation of Space 3D, a realistic spatial algorithm developed at Sonic Arts R&D (Qualcomm Institute). The Space 3D system is capable of recreating the acoustics of the environment based on the virtual models in real-time using advanced multi-processing ray-tracing techniques. The piece offers visual, auditory, and tactile experiences to the audience, which are generated in response to a player's interactions with the environment.

Contributions

The integration and the visual design of the project were initially led by John Burnett (Ph.D.) as a collaborative work at the Opera Hack organized by SD Opera. Following their departure from the Sonic Arts team in the spring of 2021, I have been working on the artistic expressions of the piece and developing audiovisual infrastructures using the Unreal Engine under the direction of Professor Shahrokh Yadegari. I have been responsible for developing a spatial audio playback system, utilizing the Space 3D plugin, arranging audio composition, constructing graphical objects, and managing player interactions. As I designed each element in the piece, I incorporated and combined the latest technologies available, such as particle collision and hand tracking to allow a player to dynamically interact with the environment.

Technical Overview

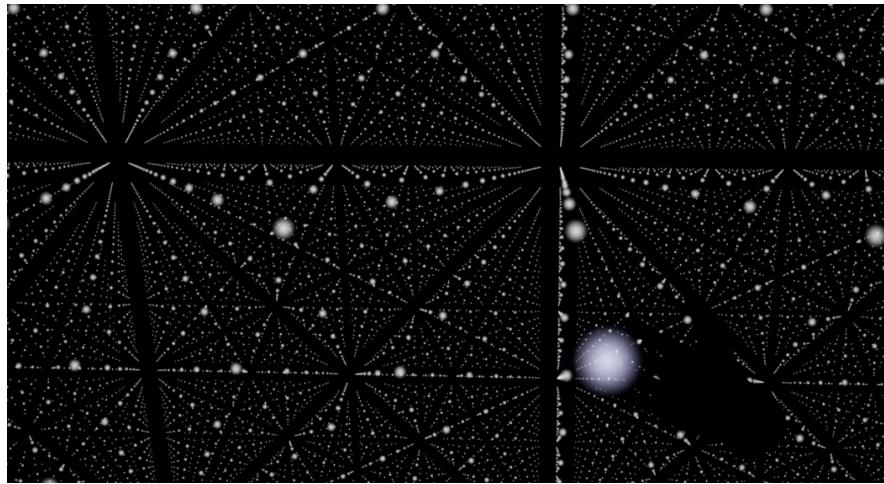
In the following section, I briefly describe the infrastructure of each element I designed in the piece.

Stars



The opening Stars Sequence features 125,000 particles controlled by the Unreal Engine's Niagara Particle System. Over the course of 100 seconds, the stars converge into a lattice structure.

Lattice





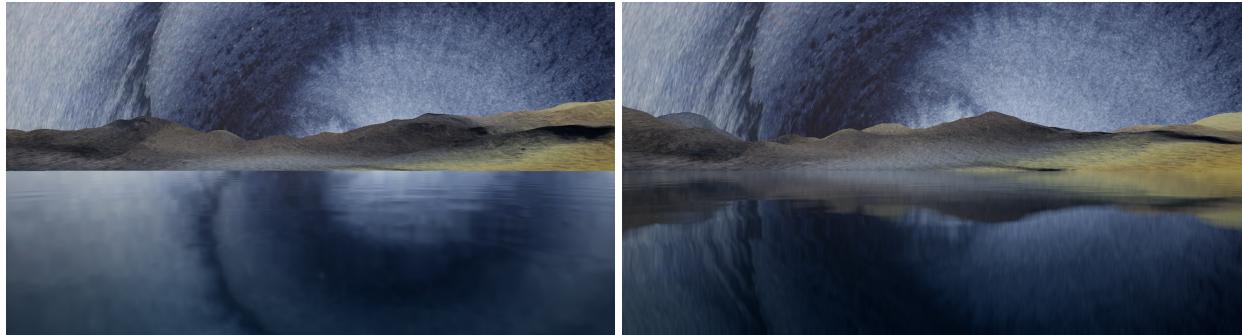
Once the Stars converge into a lattice structure, the Stars Niagara System is replaced by another system that has collision properties. In order to compensate for high GPU usage of collision calculations, the Lattice Niagara System is separated into 5 different emitters. The middle emitter features 5,000 particles that can be interacted with a player's virtual hands. The 4 other emitters make up 12,000 particles that can not be interacted with.

Water



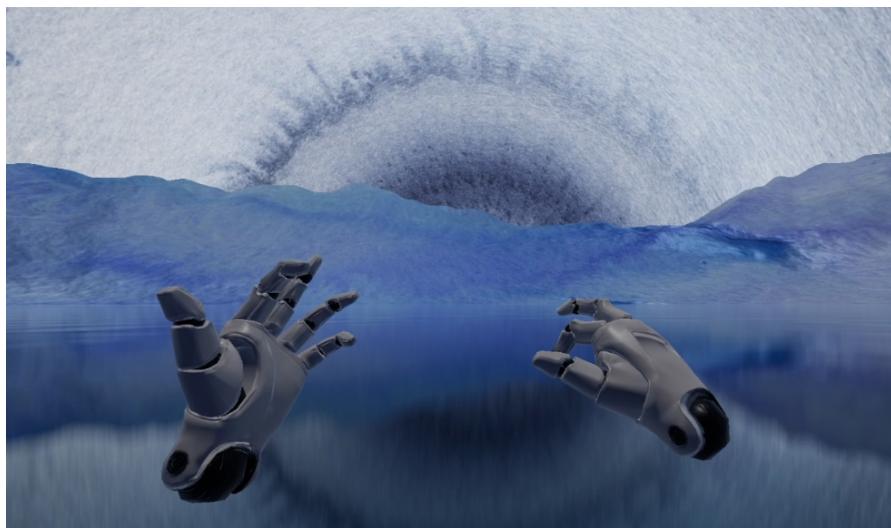
The water is created by using the Unified Interactive Water System (UIWS), a plugin for the Unreal Engine designed and distributed by Elliot Gray. Some of the main features the plugin offers include wind turbulence, ripple interaction, and underwater post processing.

A Planar Reflection is placed above the water component to enable real-time reflections on the surface of water. With higher rendering cost, Planar Reflection offers more realistic reflections than traditional Screen Space Reflections.



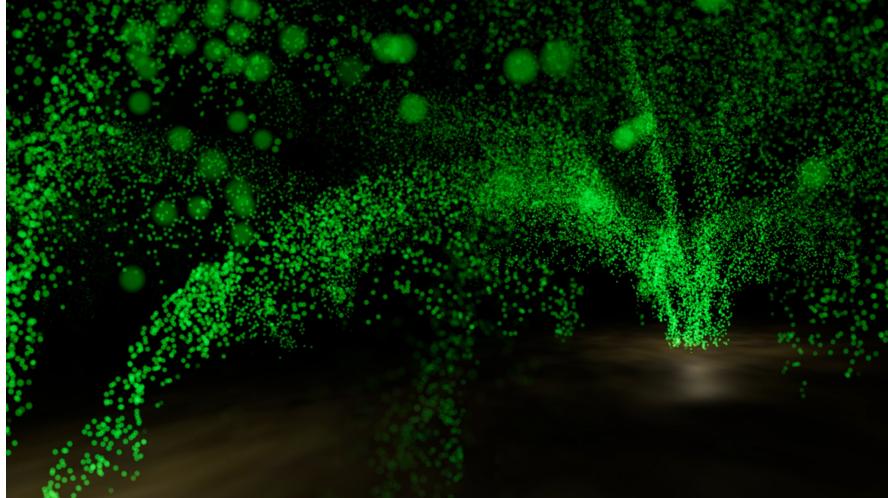
Planar Reflection Off (left) vs. Planar Reflection On (right)

Hands & Haptic Feedback



Through the use of SteamVR, a player's finger movement is mapped to the hand skeleton. While a hand mesh is colliding with the water, its velocity is mapped to the intensity of the haptic effect on the corresponding controller. The haptic effect is also played when a hand mesh collides with a particle in the Lattice Niagara System.

Plants



The Plant Sequence features eight instances of the Unreal Engine’s Niagara System with 100,000 particles. The particles are spawned on a mesh surface to create the plant shape. The position of each particle is dynamically modulated by noise and gravity force, whose intensity is adjusted over time. A player is able to walk around the environment as each plant grows and dies.