ORBit

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Project Description

The goal of this project is to create an instrument that is unique to the possibilities VR offers. ORBit is a new “impossible” instrument that includes both moveable objects and a customizable environment. ORBit is played by grabbing and moving the sound orbs around in the space. The y-axis is mapped to pitch, and is locked to a D scale. The user can choose between chromatic, major, and minor tonalities via a semi-diagetic menu in the scene. The two effects objects (floating lights) represent a low-pass filter and a distortion filter, and both will apply their effects proportionally to any sound orb in their proximity. They can also be grabbed and moved around at will, though unlike the orbs their altitude in the scene does not affect their function. Orbs will stop producing sound if placed back in their original position on their color-coded shelf.

ORBit allows several new forms of musical expression, including large-scale interaction, a three-dimensional sonic display, and auditory fluidity based on human body movements. This allows for full-body interaction with the instrument and it can be used to accentuate a performance. The instrument pulls foundation from the existing notions of spatialization, harmony building, and natural interaction.

This instrument would be very difficult to realize outside of VR, largely due to its use of all three cartesian coordinate axes. Thanks to VR, we can easily add a number of unrealistic features - the orbs are suspended in mid-air, the effects objects don’t appear as rigid bodies, and we have a lot of flexibility in how the parameters of the sounds are mapped. Additionally, performers can enjoy the perceived privacy that VR gives. It might appear as an idiot waving arms around for an external viewer, but the interactions inside VR fun enough to engage the performer. It was actually a lot of fun to create melodies, chords, and basslines this way.

ORBit is intended for personal and casual musical experiences, and could easily be adapted for a gallery installation. This is due to the “solo-user” style that virtual reality equipment currently lies, as well as the fact that our instrument is designed around a small space with a single camera.

Project Evaluation

DESIGN PROCESS

Audio

The audio design for ORBit stemmed from the idea that we would have continuous drones affected in game by various effects. Our first iteration of sounds was a grouping of 4 fairly complex drones that contained a good amount of modulation to begin with. When we added these to the effects we had in unity, we noticed that it was difficult to discern when effects were being applied to the sounds because they were already filled with modulation. This lead us to our final design of using 4 simple drones, and adding the easily-noticeable unity effects of pitch shifting, distortion, filtering, and chorusing. The drones consist of a bass, root, 3rd and 5th, but when pitch shifting is added, you are able to change these designations. We eventually settled on having a bass note and three others at the same pitch an octave above, as this makes visualizing chords and intervals more intuitive. With more time, we might have differentiated these three sounds timbrally.

Control in VR

Hands and grabbing is the core control for ORBit, which we built base on Oculus sample assets. All of the sound mapping is handled through scripting - the usable portion of the y-axis is divided into ‘note zones’, and each orb’s pitch is changed based on which zone it’s in. Our original idea was to map effect parameters to the other axes, but we took some professorial advice and utilized objects instead to make the experience more cohesive. Scale locking was one of the last parts to be added once we realized it wouldn’t be too difficult, and the major/minor function was rushed in at the end. The code is pretty messy for this feature due to time constraints, and the in-scene menu for choosing tonality is even hackier. It does work, though.

Visual

Since the basic game mechanics for ORBit is based on the Cartesian coordinates, the visual design aimed to enhance the audio experience and make the playing of ORBit more enjoyable. We explored multiple ways to achieve this and landed on using the particle systems for mainly two reasons: 1. It’s less taxing on the computing power for visual rendering. Ensuring a non-interrupted experience takes a high priority; 2. We can easily script interactions using public parameters in the particle system modules.

CHALLENGES

Conceptual Challenges

The main conceptual challenge comes from mapping. For the audio component, it took the team a while to decide whether to use Cartesian coordinate or relative proximity to map as both had pros and cons. Objects are naturally more intuitive, but it could be more difficult to get desirable sounds as opposed to axes. At the end, our team found a happy medium, using some of each in the design of the ORBit. For the visual component, since it took our team a while to decide on which axis maps to which sound effect, the visual design had to wait. Also, at the beginning each team member has a different vision about how the visual would map to the interaction but we were able to reach a common design solution in the end.

Technical Challenges

Realizing the core interactions was overly difficult, once some initial setup hurdles were passed. It did take a while to write/debug all the necessary scripts and keep things organized, but it wasn't too crazy. We did have an issue with mapping pitches to notes, but once we learned about the twelfth root of two algorithm that sorted itself out just fine.We had planned to link changes in pitch to visual changes in the participle system, yet it was not realized as we could not figure out how to call out the variable for pitch.

STRENGTH

ORBit is strong in interactive simplicity, apparent cause and effect, and visual cohesiveness. The user is given limited options once the game launch. It's intuitive to pick up a sphere when facing 4 glowing orbs and no sound. Once a sphere is picked up, the complexity layers on progressively. For one sphere, players can start with placing it at different heights in the space and receive instant audio feedback. They can also move the sphere closer or further away from the the floating lights for special effects. Then, the complexity gradually increases as more spheres are added to the scene and interact with the floating lights. If they find current sounds in the scene too overwhelming, players are allowed to place the sphere back. ORBit also strives for simplicity in audio design. It delivers a large range of timbral experimentation, that stems from just 4 audio samples. This allows for clear and harmonious combinations, and makes it difficult for the user to make something that sounds "bad".

IMPROVEMENT

If given more time, our team would like to improve ORBit on the performative and visual aspects. Following improvements can make ORBit more performative: 1. More flexible control over key and scale; 2. support user demonstration and recording of animations,

which could be played back and looped to facilitate a performance; 3. Allow user to add more orbs in the space by pressing a button; 4. Add an environment switch, that change the overall sound qualities in the space. This will create more rhythmic possibilities. Visual can be improved in mainly two ways: 1. Update the visual effects based on changes in sound quality; 2. Add a visual representation of the scale degrees to allow more accurate control.

REFLECTIONS

Idea Development

Since we had many ideas to begin with, the overall design development is a scoping process. The initial idea was to map three qualities to three access. However, we realize the movement along horizontal axis is not as intuitive as the up and down movement. Therefore, we simplified the design to mapping the pitch to vertical axis. We also had the initial idea of moving the spheres to different rooms. However, once we decided to use the Cartesian coordinates rather than relative proximity for mapping, we had to confine the the spheres to a smaller space. Generally speaking, the design development helped us distill the core of the design. In making all the design decisions our goal was to keep the instrument straightforward and easy to pick up.

New Music Expression

ORBit affords new means of musical expression by allowing sounds to be mapped at room-scale in a three-dimensional environment. No physical instrument is able to do this, thus creating an expansive recreation of sound design. Players can have a full body interaction with sound in space by placing objects that defies gravity or inertia.

Individual Contribution

Aaron Willette: Scripting, Interaction Mechanics
Lusi(Ruth) Wang: Visual Design, Interaction Design
Benjamin Roberts: Audio, Lighting Design