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Ambient Sounds of the Amazon and the Bajón Grande

**Introduction**

 The Amazon River Basin is a hotbed of noise: the sounds of wind through the trees, rain falling through the layers of canopy above, bugs, birds, monkeys, and flowing water are constant. A silent rainforest would be quite disturbing—the noise floor in the jungle is indicative of the myriad life in one’s surroundings, and a lack of noise would signal a dead rainforest. For the final projects, many of the models are being placed in the environment they come from, the Amazon River Basin. As any live rainforest needs sounds, so too does the digital rainforest of our class’ creation. For the first part of my final project, I created the soundscape which envelops our digital environment. From the sounds of wind to specific animals, to even some of the character footsteps, each sound helps create a more immersive environment in the digital simulation we created as a class.

 For the second part of my project, I used Autodesk Maya to model the Bajón Grande, a large panpipe native to the Moxos of Bolivia. The instrument, normally played in pairs, is composed of ten tubes of wrapped bark, each of a different length, which have mouthpieces attached to each. These are tied together with rope, and each tube has its note labeled on a faceplate, which is attached to the front of the instrument. To play the Bajón Grande, one holds it at an angle down and away from the face, and blows into the mouthpiece via a hard unvoiced bilabial trill (vibrating the lips together while both are tensed, as if rolling a “p”). This native instrument forms the bass notes of the Moxos ensemble, which includes both instruments from the Moxos people as well as European instrumentation.

 To accompany the 3D model, I also used physical modeling synthesis to recreate the sound of the Bajón Grande. This kind of sound creation uses equations based on the properties of an instrument to create the waveform that is activated via a MIDI signal. For example, if one were to model the sound of a drum, an equation for the force of a drumstick impacting the membrane would be combined with qualifiers such as membrane density, length and diameter of the drum, materials used for the drum and drumhead, and the tension of each piece involved. One of the stock plugins in Logic Pro X, Apple’s digital audio workstation, is Sculpture, a somewhat-simplified physical modeling synthesizer capable of recreating real world sounds based on the acoustic properties of four materials combined with multiple articulation sources (such as bow, blow, strike, impulse, and others). Sculpture also contains modeling equalizers, modulatable parameters—tension, media loss, velocity change, and filtering, among others— and a saturation unit for coloration. The sound of the Bajón Grande could be described as bassy, woody, and brass-articulated, adjectives which all relate to modifiable parameters within Sculpture’s interface.

**Process/Results**

 For the ambient sound work, which is also known as foley design, I sought out mostly sounds from the actual Amazon (other than footsteps and flowing water, which are able to be more generic due to their ubiquity in different environments). The ambient sounds of a rainforest are, for the most part, composed of wind, rain, and a constant blanket of frogs croaking, insects buzzing, and crickets chirping. These sounds were envisioned to be ambience, independent of character direction, and changeable by zone, time, or weather. Other noises one would hear in a rainforest are more specific. Certain birds, amphibians, and monkeys create quite iconic noises which are more distinct and rare, often discernible in direction. For these sounds, placement as a spot source would work better due to the ability to aurally locate spot sources using the directional audio engine in Unreal. For bodies of water, sounds of rivers, streams, and waves lapping against shores are easily placeable within the geography of the scene programmed in the game engine. Finally, while the player character does not necessarily interact with objects or characters within the world, the sound of footsteps across the different surfaces (such as leaves, dirt, and through water) add an extra sense of depth and realism to the scene.

 I used two main sources for the sounds to put in the Unreal scene. The first was FreeSound.org, a website where anyone may upload whatever sounds they choose, from modular synth riffs to live funk jams to foley sounds. Keywords such as “amazon,” “rainforest,” and “Bolivia,” coupled with modifiers like “night,” “day,” “rain,” and “sunny,” were sufficient to find numerous sounds, which I was able to filter by copyright status. All the sounds from FreeSound.org that were used in this project are licensed under the Creative Commons 0 License, which means that they are dedicated to the public domain and are free for any use, including commercial, for no fees and without asking permission.[[1]](#footnote-0) This kind of licensing was and is incredibly useful to me, as the microphones used for foley recording and travel expenses to the Amazon are incredibly expensive. My second source, for some of the footsteps, was a royalty-paid sample pack from Cymatics.FM. The company’s latest soundpack, “Infinity,” contained a bonus pack of thousands of foley sounds that are licensed to owners of the sample pack to use however they wish.

 I created the model of the Bajón Grande using Autodesk’s Maya software. First, reference images were sourced from Google, by recommendation of Professor Erickson, as well as reference videos from YouTube.[[2]](#footnote-1) To create the tubes, which resonate the air to make the body of the instrument’s sound, I first started with a pipe primitive. I then stretched the shape out vertically and thinned the outer wall by expanding the inner edge loop.[[3]](#footnote-2) This shape was then duplicated nine times, each resized, for a total of the ten tubes of the Bajón Grande. To create the mouthpieces, another pipe was used as the base shape. To this pipe, since the mouthpiece of the Bajón Grande is carved into a shape wider on one end than the other, I added edge loops, which I then resized to reshape the cylinder into a shape more resembling a mouthpiece.[[4]](#footnote-3) The mouthpiece was also duplicated nine times so that there was one mouthpiece per sound tube. The final piece of the Bajón Grande is its faceplate, which is tied to the front of the instrument, just below the mouthpieces. Initially, I misinterpreted the photos and created a faceplate that wrapped all the way around the instrument. However, upon further review, I decided to recreate the faceplate for the final model. I began work on the faceplate with a cube primitive. To create the feel of a slightly uneven, carved faceplate, I first stretched the cube into a shape more resembling a flat plate. Adjusting the edges, I angled out the back face while slightly shrinking the front face. Smoothing was added to each piece in order to soften some of the more obvious angles.[[5]](#footnote-4)

 Texturing the Bajón Grande required three separate textures. Given the matte texture of the instrument, I used Lambert surfaces for each piece. First, for the tubes, which are made of strips of bark tied together in long sheets and wrapped into cylinders, I used a texture which I found online of a bamboo sushi mat. When tiled correctly, this texture looks surprisingly similar to the bark wrappings of the Bajón Grande.[[6]](#footnote-5) The mouthpiece was textured using the default “Wood Grain” texturing tool in Maya. I adjusted the base and grain colors until I got a reddish wood that mimicked the colors I saw in the pictures I found. Not using an image as the texture was convenient because the grain of the wood naturally follows the curves of the mesh to create a texture which tiles perfectly.[[7]](#footnote-6) The faceplate texture was, however, somewhat more challenging. Unfortunately, when I tried to use Autodesk’s Mudbox software, it crashed upon opening multiple times. Thus, I was unable to achieve the detailed, note-marked faceplate which decorated most of the Bajónes I saw in the pictures I referenced. However, in the Youtube video of the “Ensamble Moxos,” the instruments played have a plain faceplate. So, I used the “Wood” texturing tool in Maya to simulate the wood of the Bajón’s faceplate.[[8]](#footnote-7) Fig. 9 shows the final, textured model of the Bajón Grande.

 Apple’s Sculpture is a very complex synthesizer, and some of the decisions I made in recreating the sound of the Bajón Grande seem counterintuitive. However, in most cases, a trained ear can be more accurate in judging the timbre and quality of a sound than the intended use of a synthesizer. To start, I first created the best interpretation of how air flows through the Bajón Grande. The “Blow” and “Bow” together create the articulation of the hard unvoiced bilabial trill used to vibrate air through the mouthpiece within the instrument. To curb the sound from clipping the simulated pickups in the plugin, the third source used was “Bound,” placed all the way at one end to rein in some of the upper harmonics which caused buzzing. For the material, “Wood” caused a high pitched screech which was untameable, while “Glass” and “Steel” both caused a metallic tone which could not be corrected via equalization or modification of any of the other parameters in the synthesizer. Thus, the material matrix was set to “Nylon,” given that it had the woodiest sound to my ear. The waveshaper and filter were then used to add some harmonic content in the low mids, as well as add a small peak where the airiness lies on the frequency spectrum. The envelope of the sound consists of a short attack followed by a sharp decay into a lower sustain, simulating the initial puff of breath to start the vibration of air, followed by a lesser breath to keep the air in the instrument vibrating. The “Body EQ” section contains modeled equalizers of resonance patterns of different instruments. For the purposes of a deep, bassy instrument, I used the modeled “Double Bass 1” equalizer, which I modified using the three knobs as well as the “Fine Structure” slider until the desired timbre was reached.[[9]](#footnote-8) To further accentuate the initial attack of the instrument, a small burst of white noise was used. The two tracks (instrument and noise) were then grouped together and equalized for the final product, which was set to play via MIDI signal to simulate the sound of two Bajón players practicing.

Citations and References

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1. Fig. 0. [↑](#footnote-ref-0)
2. Fig 1. [↑](#footnote-ref-1)
3. Figs 2, 2.1. [↑](#footnote-ref-2)
4. Fig. 3. [↑](#footnote-ref-3)
5. Fig. 4. [↑](#footnote-ref-4)
6. Figs 5, 6. [↑](#footnote-ref-5)
7. Fig. 7. [↑](#footnote-ref-6)
8. Fig. 8. [↑](#footnote-ref-7)
9. Fig. 10. [↑](#footnote-ref-8)