A Soundscape in the Virtual Reality World: How to Economically Design a VR Soundscape Assignment

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Abstract

This paper delineates an economically efficient approach to crafting a virtual reality (VR) soundscape assignment using a modest number of high-performance computers and VR headsets. The methodology outlined facilitates the integration of VR assignments into diverse educational settings, spanning from K-12 to college classrooms. The proposed solution advocates for the implementation of a collaborative VR soundscape project as a resource-effective means to design immersive assignments, offering students both personalized creative sound spaces and a communal sonic environment.

Keywords

Soundscape, virtual reality, Unity, Free Assets, 360° video, ambisonics

Introduction

With the advent of affordable VR headsets such as Oculus Quest and the VIVE series, there has been a surge in VR project creation by game developers and artists leveraging emerging technologies. However, for beginners, venturing into VR project development is hindered by the intricacies of technology and constrained budgets. This paper aims to document and share the developmental journey of a VR soundscape assignment designed for a 500-level sound art course, serving as a valuable resource for educators seeking to incorporate VR projects into their curricula. The narrative unfolds the successful execution of a collective VR soundscape project, detailing the challenges and learning experiences encountered during a year-long course development with VR technology. To facilitate the integration of a VR assignment into the sound art course, I secured a Virtual Environment Grant, approximately $3,000, from the Center for Teaching Excellence at the University of South Carolina. This grant enabled the acquisition of essential equipment and paved the way for the design and implementation of the VR soundscape assignment. The study encompasses four key phases: researching VR equipment, undertaking a 360° video project, crafting a Unity-based VR soundscape project, and establishing a sustainable environment for the continuous development of the VR soundscape project.

Researching VR Equipment

Soundscaping, akin to the artistic manipulation of nature in landscaping, involves creatively reshaping a space by manipulating surrounding sound resources. To prepare students for a VR soundscape assignment, I conducted an initial workshop utilizing a 360° video camera and an ambisonics microphone. This hands-on experience provided them with an immersive understanding of a soundscape environment. In other words, the course necessitates two primary equipment types: a 360° video camera set and a VR headset. Constrained by a $3,000 budget, I meticulously estimated the required equipment costs before making any purchases. Researching cost-effective options, I opted for an Insta360 ONE RS 1-Inch 360 Edition Camera (approximately $880), Zoom H3-VR microphone (approximately $275), Oculus Quest 2 headset (approximately $400), and a laptop (approximately $1,300).

Figure 1. The 360° video result at the workshop. Viewers can change the angle of the video on YouTube. Screenshot by Byeongwon Ha. ©Respect Copyright.

Undertaking a 360° Video Project

Utilizing the Insta360 ONE RS and Zoom H3-VR, I orchestrated a 360° video workshop, mirroring a conventional filming environment involving directing, cinematography, sound recording, and acting. Students crafted a narrative featuring four actors encircled by a 360° video camera, engaging in a clockwise interaction. This static scenario provided an immersive understanding of a 360° visual world. Following ZoomSoundLab's instructions for Premiere Pro setup, the collaborative effort resulted in the successful completion of a 360° video project. [1] Challenges arose

during the COVID-19 pandemic, necessitating the sanitization of the VR headset for each new user, consuming valuable class time. To overcome this constraint, we leveraged YouTube's support for 360° video formats, allowing students to experience their work pseudo-immersively by manipulating the video angle with a mouse. Recognizing the need to streamline sanitization processes, this adjustment aimed to ensure that all students could fully experience their final 360° video project within the confines of the tight class schedule.
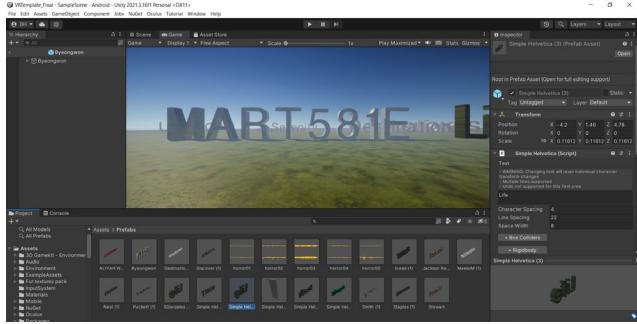

Figure 2. The abstract words in the VR soundscape. Screenshot by Byeongwon Ha. ©Respect Copyright.

Crafting a Unity-based VR Soundscape Project

Following the immersive experience of 360° moving images in the workshop, students embarked on creating a VR soundscape project in Unity. Unity provides students with not only free accessibility facilitated this endeavor, but also a professional environment for video game development. However, incorporating Oculus headset functionality required multiple installations, including Unity Editor (Ver. 2021.3.16f (LTS)), Android SDK, Microsoft Visual Studio, Oculus app, Steam VR, and SideQuest application. Navigating these setups, guided by a tutorial by Justin P. Barnett, revealed a time-consuming process beyond the regular course schedule. [2] Recognizing this, I presented the information to students, prompting them to individually design abstract 3D words by using their laptops or desktops in the computer lab. This collective project was inspired by Jeffrey Shaw's *The Legible City* (1989), which was regarded as one of the earliest and most prominent VR projects in the field of art. Instead of pictorial representation of buildings, this project shows a city, which consisted of building-sized words. Leveraging Unity's First-person template and free assets like Simple Helvetica (Ver. 1.02b) and World Materials Free (Ver. 3.0.1), students crafted word-based soundscapes with at least five sound sources. [3, 4] The spatial sound setup required them to design interactive soundscapes aligned with the player's position. After creating a satisfactory word-based soundscape, they exported it as packages. This facilitated the collection and juxtaposition of individual soundscapes into a final collective composition in Unity.

To streamline the process and accommodate limited headset availability, students posted their packages to a virtual classroom. Merging these packages into a comprehensive VR Unity project, we overcame headset limitations and

saved considerable time. During the final presentation, students navigated the VR soundscape world, showcasing their individualized creative sound designs. Limited by time constraints, headset sanitization occurred within 30 seconds, allowing each student a three-minute exploration of the VR soundscape. Each student experienced the soundscape in a different way since the end position of the previous player became the start position of the next player. This made them continue to talk about their own stories after the VR experience. This assignment not only provided a novel approach to sound design but also offered a transformative experience in creating and appreciating significant soundscapes.
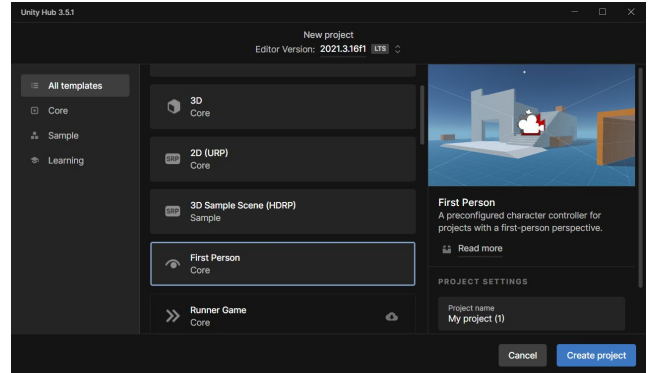

Figure 3. The First-Person template on Unity Editor Version: 2021.3.16f1 (LTS) Screenshot by Byeongwon Ha. ©Respect Copyright.
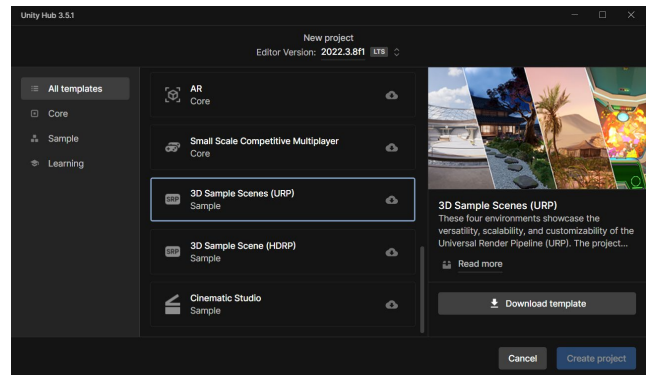

Figure 4. The 3D Sample Scenes (URP) template on Unity Editor Version: 2022.3.8f1 (LTS). Screenshot by Byeongwon Ha. ©Respect Copyright.
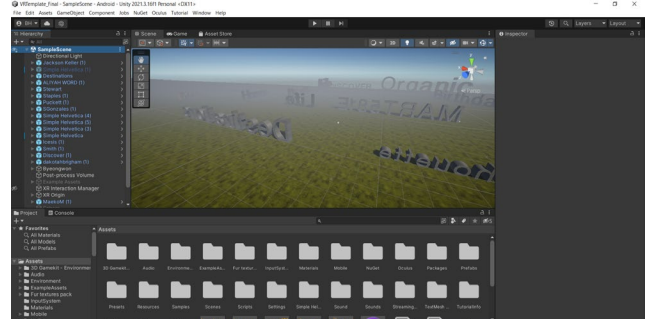

Figure 5. The composition of abstract words in the VR soundscape. Screenshot by Byeongwon Ha. ©Respect Copyright.

Establishing a Sustainable Environment for the Continuous Development of the VR Soundscape Project

Given the rapid evolution of VR devices and their development environments, meticulous documentation becomes imperative for reenacting projects in subsequent semesters. Specifically, considering the possibility of the YouTube tutorial links becoming unavailable, it's crucial to directly document the development environment with a script. During a Unity Editor update (Ver. 2022.3.8f1 (LTS)) for the next semester, a notable change emerged: the absence of the First-person template. This necessitated thorough research to provide new students with a comparable soundscape development environment. Consequently, students adapted by utilizing the 3D Sample Scenes (URP) template to create individualized soundscapes with abstract words. Additionally, updating the VR headset recognition on my laptop mandated the corresponding update of previously installed applications. While not inherently challenging, this process was time-consuming, emphasizing the need for practitioners in this field to stay abreast of evolving technologies and continuously update project documentation to ensure seamless transitions across semesters.

Conclusion

The internal course enrichment grant enabled the incorporation of emerging technology into the curriculum, resulting in the design of a novel assignment. Recognizing the constraints posed by limited resources and course schedules, a strategic division of the development procedure into individual creation and collective soundscape composition facilitated the crafting of a creative collage-based soundscape within the constraints of limited VR devices. Given the diverse devices and applications integral to the VR soundscape project, meticulous documentation becomes essential. This documentation serves as a crucial resource for future endeavors, allowing users to revisit and effortlessly update the development environment, ensuring continued accessibility and relevance.

Acknowledgements

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