STAG: Smart Tools and Applications in Graphics (2024)
T. G. Dulecha, U. Castellani, and A. Giachetti (Editors)

The use of Virtual Reality in preserving and reactivating immersive audio art installations: the case of *Dissonanze Circolari* by Roberto Taroni

Alessandro Russo[1], Nikoo Fayyaz[1] and Andrea Franceschini[1]

[1]Centro di Sonologia Computazionale, Department of Information Engineering, University of Padova (Italy)

Abstract

Interactive multimedia artworks pose unique challenges for their preservation, such as the obsolescence of original components, software, and playback devices, and other issues related to their interactive and time-based nature. The Centro di Sonologia Computazionale (CSC) of the University of Padova developed the Multilevel Dynamic Preservation (MDP) model, which aims at ensuring the long-term preservation of multimedia artworks by treating them as dynamic objects. Reactivation is a fundamental step for allowing their preservation, and, among various reactivation strategies, Virtual Reality (VR) provides a unique opportunity to recreate the immersive experience while still maintaining the concept of the original artwork. The CSC started to work together with Italian artist Roberto Taroni, a central figure in the experimental scenario, who often combined music and visual arts in his works. This contribution concerns the reactivation in VR of Roberto Taroni's artwork "Dissonanze Circolari" from 1999. This installation featured a room with 16 speakers, each one playing a fragment of Beethoven's piano performance, Op.111, executed by different musicians, creating a dissonance-based immersive experience. The reactivation was carried out using the documentation provided by the artist and the audio samples from the original installation. The VR environment was created using the game engine Unreal Engine 5. This reactivation approach allows to maximize access to the artwork, providing new information for curators, scholars, and art enthusiasts.

CCS Concepts

• ***Applied computing*** → ***Media arts;***

1. Introduction

Due to their complex and heterogeneous nature, interactive multimedia art installations pose unique challenges for curators and conservators, emphasizing the importance of developing specific and dynamic preservation strategies capable of tackling the issues of preserving the variety of hardware, software, technologies, and audiovisuals that form the final artwork. The necessity to reactivate interactive art installations thus stems from (i) their multifaceted nature, (ii) the short lifespan and obsolescence of their digital and analog components, and (iii) their time- and process-based nature. In response to these requirements, the literature presents various approaches, including several European projects focused on the preservation and documentation of interactive multimedia installations, such as the works of ZKM and Horizon's project *Dynamic Preservation of Interactive Art: The next frontier of Multimedia Cultural Heritage and New Approaches in the Conservation of Contemporary Art (NACCA)*. The Centro di Sonologia Computazionale (CSC) [CDPV22] of the Department of Information Engineering (DEI) of the University of Padua began addressing the issue in 2014, leading to the development of the Multi-Dynamic Preservation (MDP) Model [FRP*23]. This model introduces the concept of Digital Preservation Object (DPO), representing a single instance of the artwork, with the aim of maintaining the relationships and interactions between all its reactivations. The model is currently still under development, employing different reactivation strategies for different case studies.

2. Virtual Reality

Virtual Reality (VR) is one of the most promising emerging technologies in the field of multimedia art preservation. Recently, a greater awareness of transitioning to digital media is providing new perspectives for novel approaches to preservation. In fact, although VR has already been explored in several contexts (e.g., computer-based art [Hol11] and computer music [LVF*09]), the relationship between VR and the preservation of contemporary art has yet to be fully investigated [Loc20]. In considering the reactivation options for this artwork, together with the artist we gathered the following three must-have requirements: (i) aesthetically accurate presentation of the physical features of the original installation, with particular emphasis on the spatial aspects which are critical to the experience of different dissonances based on room positioning; (ii) com-

DOI: 10.2312/stag.20241349

parability of the materials before and after the digital restoration process; and (iii) accessibility of the artwork to a an audience as wide as possible. Although it may seem that these three requirements could be satisfied with a physical installation, the effort and resources necessary were deemed too onerous by both the artist and the development team. We considered that VR satisfies all three requirements in a much less resource-demanding way, in particular: (i) it enables an accurate representation of the installation using bespoke period-appropriate visual and acoustical models; (ii) it enables comparing pre- and post-restoration materials at the flick of a switch; and (iii) the digital format frees the installation from the physical limitation, enabling wider access and participation.

3. Case study: *Dissonanze circolari* by Roberto Taroni

Roberto Taroni emerged in the 1970s as a key figure in the Italian art scene, integrating sound (notably electronic music) and visual arts. His work spans multimedia installations, films, performances, and expanded cinema [You20]. His extensive collection includes numerous films and a substantial archive of sound materials used in installations and live performances. The CSC now preserves his audio archive, covering both analog formats like magnetic tapes and digital media. This project follows a 2022 film digitization effort by the University of Udine's *La Camera Ottica Film and Video Restoration Lab* within the Italian Council Program [MPCT23]. Our goal is to use these restored materials to revive the original installation, ensuring an authentic public experience faithful to Taroni's artistic vision [RFRC24]. A notable work is *Dissonanze circolari* (1999), presented at the *Città della Scienza* in Naples. This sound installation, unique in Taroni's oeuvre for excluding video or film, featured 16 speakers playing different interpretations of Beethoven's Op.111 piano piece. The resulting dissonances and variations, influenced by the listener's position, create a dynamic and immersive sonic environment.

4. VR reactivation

We implemented the VR reactivation using Unreal Engine 5 (UE5), a popular, high-performance 3D game engine frequently used in VR, and we used a Meta Quest 2 headset for development and testing, using the OpenXR framework. We modeled the environment inside UE5 based on the description given by the artist, to recreate the experience as faithfully as possible. We used freely available 3D models downloaded from Sketchfab for the speakers, and selected those that, according to the artist, most closely matched the speakers used in the original installation. We placed the audio sources to match the positions of the speakers, so to recreate the spatialization effect of the audio sources, using Unreal's spatial audio system playing in stereo mode through the headset's headphones. This setup provided an accurate experience, which the artist considered comparable to the one experienced in the original installation. The audio tracks playing through the speakers come from the original installation and were provided by the artist. We kept the visuals as clean and minimalist as possible because of the technical limitations of the Meta Quest 2 headset, which worked well in emphasizing the aural nature of the installation, without detracting from the overall experience. The result is a virtual environment in which all the important visual elements are present, while all the elements deemed unnecessary by the artist were removed – such as power and audio cabling. We kept the lighting simple and diffuse to minimize the need for complex shadow casting, which could be an issue in older headsets. Such reduced system requirements enabled us to also deploy on older headsets such as the Oculus Quest, and a WebGL version is planned for the future, to further widen public access to the artwork.

We performed iterative, lightweight evaluation during the development process. We asked colleagues, both with and without VR experience, to test the reactivation and to provide informal feedback particularly in terms of motion sickness and the audio-visual experience. We recorded no cases of motion sickness, and the audio-visual experience was received overall positively by all the testers. We are planning formal testing in the near future, which will include experiential aspects such as the verisimilitude of the audio-visual experience, and the usability and perception of the pre- and post-restoration comparison.

Figure 1: *VR reactivation of Dissonanze cognitive by Roberto Taroni*

5. Conclusions

VR proved to be a valuable tool for revitalizing and reactivating multimedia art installations. In particular, in the reactivation of *Dissonanze circolari*, VR allowed us to faithfully recreate the immersive, interactive environment of the original installation. This technology offered a fresh and captivating way to experience the artwork by immersing the viewers in a three-dimensional virtual environment while maintaining the original artistic concept. Furthermore, this technology proved to be useful not only in preserving but also in maximizing access to multimedia artworks. In fact, VR also enhances accessibility, allowing individuals with disabilities and/or located far away to engage with the artwork without needing to visit the installation in person. We plan to make this reactivation available on the artist's website, offering both a traditional 3D desktop version and a fully immersive VR experience for users with compatible hardware.

References

[CDPV22] CANAZZA S., DE POLI G., VIDOLIN A.: Gesture, music and computer: The centro di sonologia computazionale at padova university, a 50-year history. *Sensors 22*, 9 (2022). URL: https://www.mdpi.com/1424-8220/22/9/3465, doi:10.3390/s22093465. 1

[FRP*23] FIORDELMONDO A., RUSSO A., PIZZATO M., ZECCHINATO L., CANAZZA S.: A multilevel dynamic model for documenting, reactivating and preserving interactive multimedia art. *Frontiers in Signal Processing 3* (June 2023), 1183294. doi:10.3389/frsip.2023.1183294. 1

[Hol11] HOLLING H.: Virtualization as a Preservation Strategy for Computer-based Art: An (Empirical) Study into the Installation I/Eye (1993) by Bill Spinhoven van Oosten. 1

[Loc20] LOCKHART A.: VR as a Preservation and Simulation Tool for Media Art Installations: ISEA 2020. *26th International Symposium on Electronic Art ISEA2020 PROCEEDINGS* (2020), 700–703. URL: https://isea2020.isea-international.org/summit-on-new-media-art-archiving/. 1

[LVF*09] LOMBARDO V., VALLE A., FITCH J., TAZELAAR K., WEINZIERL S., BORCZYK W.: A Virtual-Reality Reconstruction of Poème électronique Based on Philological Research. *Computer Music Journal 33*, 2 (June 2009), 24–47. doi:10.1162/comj.2009.33.2.24. 1

[MPCT23] MALVEZZI J., PITROLO F., CIVIDIN L., TARONI R. (Eds.): *Taroni-Cividin: performance, video, expanded cinema (1977-1984) = edited by Jennifer Malvezzi, Flora Pitrolo*. Silvana, Milano, 2023. 2

[RFRC24] RUSSO A., FRANCESCHINI A., RODÀ A., CANAZZA S.: Revitalizing multimedia art: Restoration and re-activation of an audiovisual installation in virtual reality. In *Proceedings of the Immersive Sound and Music Computing Conference 2024, SMC24* (Porto, Portugal, 2024). 2

[You20] YOUNGBLOOD G.: *Expanded Cinema: Fiftieth Anniversary Edition*. Fordham University Press, Mar. 2020. doi:10.1515/9780823287437. 2