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Case Study: Love Letter to Skating - VR180 stereoscopic post-production workflow

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Abstract

In 2024, the VR180 3D short film "Love Letter to Skating" was produced as part of a Curtin University HIVE Summer Internship project conducted by Curtin University student Cassandra Edwards (Cass for short). The film topically explores Cass's fascination with skating since her childhood years. The location for the shoot was Hyde Park, a beautiful inner-city park with extensive gardens and large over-hanging trees in Perth, Western Australia. The production was filmed using a Canon R5C camera fitted with a Canon Dual Fisheye lens. This particular paper focuses on the stereoscopic post-production workflow. All stereoscopic content filmed natively with two lens cameras have some level of stereoscopic alignment errors. In the post-production stage, the native dual-fisheye 8K footage from the camera was converted to equirectangular format using the Canon EOS VR Utility software. The equirectangular VR180 3D footage was rectified using Stereoscopic Movie Maker V2 software. The rectified footage was then imported into Adobe Premiere where it was edited and combined with sound, music and graphics for the final production. Computer graphics were composited into the final film at the correct depth within Premiere. The final production premiered at the MINA 2024 – the 13th International Mobile Innovation Screening and Smartphone Film Festival 8th November 2024.

Introduction

This paper is a case study of a VR180 short film "A Love Letter to Skating" that was produced at Curtin University in 2024. Cassandra Edwards (Cass for short) is a screen arts student at Curtin University's School of Media, Creative Arts and Social Enquiry. Cass produced the film as part of a summer internship project supported by the Curtin University HIVE [1]. This particular paper focuses on the stereoscopic post-production workflow.

The HIVE is Curtin University's data visualisation facility. The HIVE's role is to encourage and enable the use of visualisation technologies in research projects across the University. The HIVE is fitted with a range of large-scale visualisation systems (Figure 1). Around the room we have the 24-megapixel Tiled display, the Cylinder display (3m high, 8m diameter, 180 degree FOV with stereoscopic 3D support), the Wedge (two rear projected 3D screens), the Hologram Table, and finally the Dome display (a 4m diameter half sphere projection screen). Both the Cylinder and Dome displays are good for showing VR180 content, in addition to head-mounted displays.

Figure 1: The HIVE Visualisation Facility at Curtin University, Perth, Western Australia. From left to right, the displays are: Tiled Display, Cylinder Display, the Wedge Display, a Hologram Table (not shown) and the Dome display. (Image: Robert Frith, Acorn Photo)

As mentioned, Cass's film was produced as part of the HIVE Summer Internship Program. The HIVE Summer Internship Program has now been running for 10 years, and this also coincided with the 100th student (Figure 2). There's been a huge variety of projects conducted over the ten years and 100 projects, and Cass's project was conducted last Summer – November 2023 to February 2024 – of course, in the Southern Hemisphere Summer. Many of the internship projects over this ten year period have used stereoscopic display as an integral part of the project.

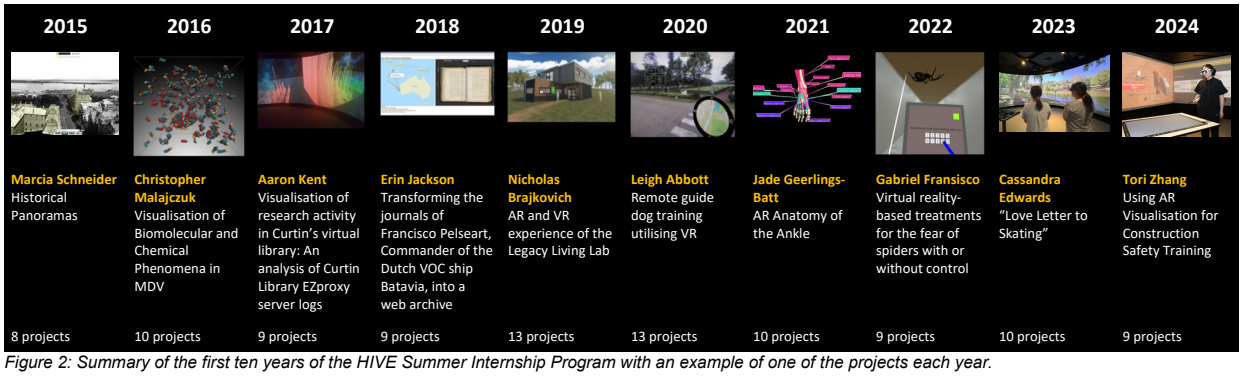

Figure 2: Summary of the first ten years of the HIVE Summer Internship Program with an example of one of the projects each year.

Immersive Cinema and VR180 Filmmaking

Immersive cinema is an experience that invites the audience into the story, to be a part of the narrative and immerses them into that world. Unlike traditional 2D cinema, you're not just a casual observer looking at the screen for passive enjoyment, you've been drawn into a space where all that exists is the narrative that surrounds you.

The production was filmed in Hyde Park – an inner-city park in Perth, Western Australia. The massive canopy of the many trees in the Park provides the perfect location for a VR180 experience which surrounds you.

The production was filmed using a Canon EOS R5C camera fitted with a Canon Dual-Fisheye Lens (Figure 3). The camera has an 8K sensor and the lens places two fish-eye images side-by-side providing 4K resolution per eye.

Figure 3: The Canon R5C camera body fitted with the Dual-Fisheye lens for VR180 capture. (Image: Canon)

Figure 4 provides an illustration of the two side-by-side fish-eye 3D images captured by the camera in a short test piece that Cass recorded in the early stages of the project.

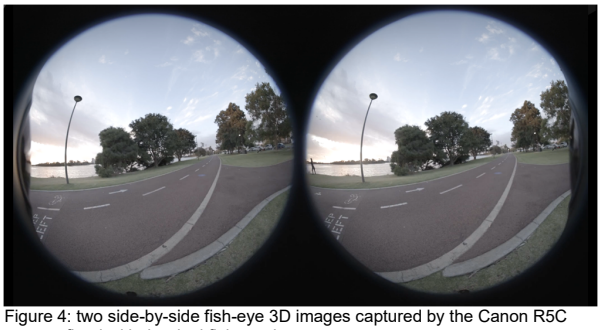

Figure 4: two side-by-side fish-eye 3D images captured by the Canon R5C camera fitted with the dual fish-eye lens.

VR180 3D Post-Production

Editing a VR180 production requires a number of additional steps on top of the steps involved in editing a regular 16:9 2D or 3D film.

Canon EOS VR Utility

The dual-fish-eye format VR180 footage captured by the Canon R5C camera needs to be converted to equirectangular format. The Canon EOS VR Utility was used to perform this conversion (Figure 5).

Figure 5: A still frame from "Love Letter to Skating" in equirectangular 180 side-by-side 3D format

StereoMovie Maker

All two lens cameras capture 3D footage with some stereoscopic misalignments, and it is important to correct or rectify the footage to remove these misalignments. For this step we used the newly released tool "StereoMovie Maker FF" from Masuji Suto in Japan (Figure 6) [2].

It is important that the stereoscopic alignment correction be performed on the equirectangular version of the footage because in this mode all stereoscopic parallax occurs only in the horizontal axis, whereas in the fish-eye view it occurs in curved axes.

Figure 6: Rectifying stereoscopic alignment using "StereoMovie Maker FF".

Previewing Stereoscopic Alignment

The stereoscopic alignment can be previewed in anaglyph mode allowing the editor to confirm good vertical alignment across the image, and confirm good choice of zero parallax distance (Figure 7).

This particular scene (Figure 7) had some stereoscopic misalignments we still haven't been able to fully remove which we're still trying to understand why – perhaps there may have been an error in the lens configuration during the original shooting.

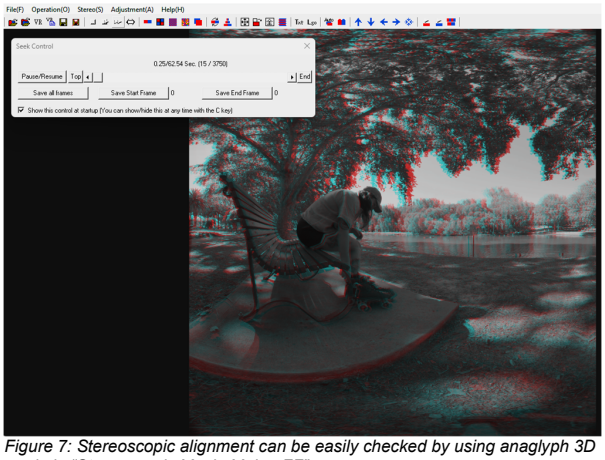

Figure 7: Stereoscopic alignment can be easily checked by using anaglyph 3D mode in "Stereoscopic Movie Maker FF".

Adobe Premiere Pro

Editing the rectified stereoscopic footage to produce the VR180 film was completed using Adobe Premiere Pro with the sequence setup to correctly display the full 8K frame (4K per left and right eye) (Figure 8).

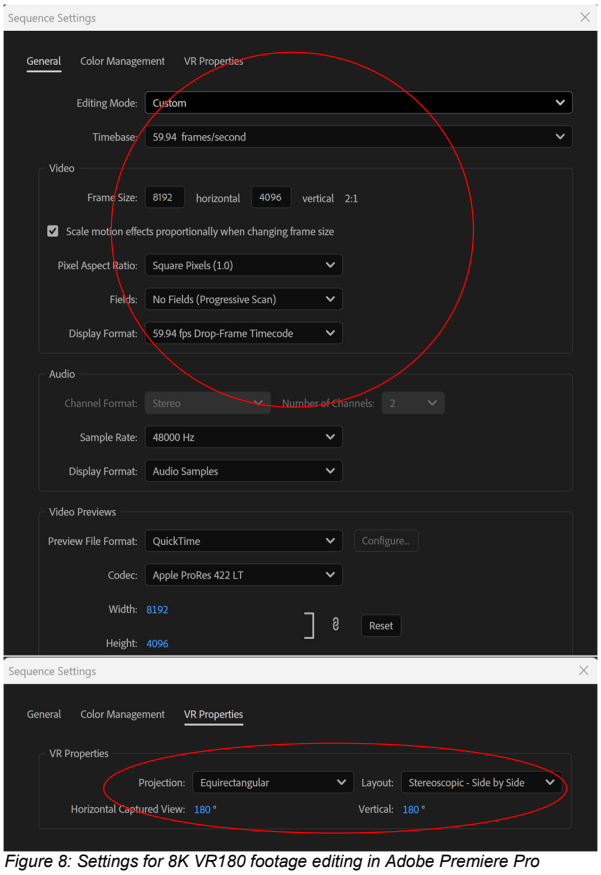

Figure 8: Settings for 8K VR180 footage editing in Adobe Premiere Pro

Premiere Pro includes the capability to preview VR180 content in anaglyph format which is an important capability for quality assurance purposes (Figure 9).

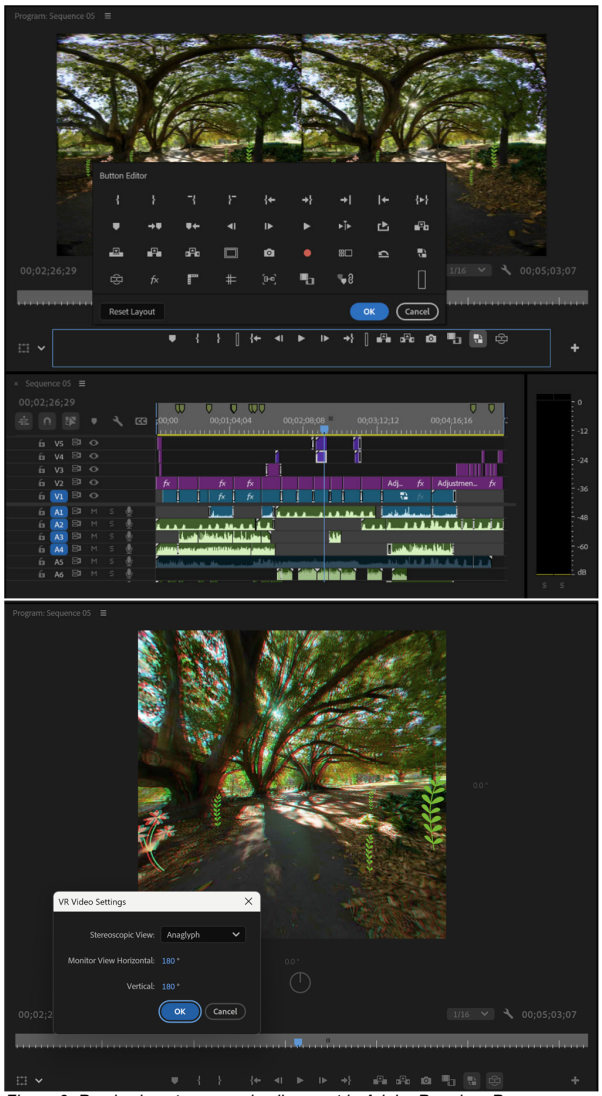

Figure 9: Previewing stereoscopic alignment in Adobe Premiere Pro

Stereoscopic Graphics

2D graphics were added to the live-action elements of the film to enhance the film. A series of 17 different graphic animations were added to the film at the correct 3D depth.

The 2D graphics were added to the scene using the "VR Plane to Sphere" tool and each graphic had to be carefully placed at the correct distance in the scene, which was quite tedious, but it was important to be conducted carefully (Figure 10 and 11).

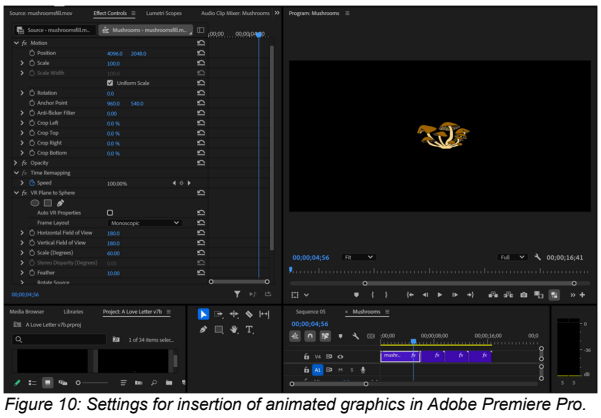

Figure 10: Settings for insertion of animated graphics in Adobe Premiere Pro.

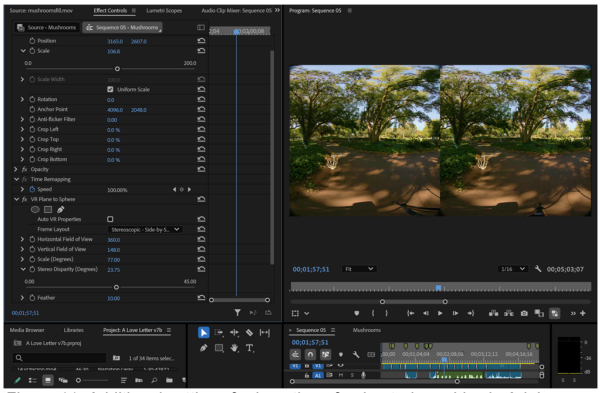

Figure 11: Additional settings for insertion of animated graphics in Adobe Premiere Pro.

The final film was rendered out from Premiere Pro in VR180 3D 4K (per eye) equirectangular format with a total frame size of 8K x 4K (8192 x 4096) in side-by-side 3D.

16:9 version

We have also created a version suitable for viewing on 3DTVs and projection screens. To create a 16:9 export we crop the equirectangular frame (Figure 12). The equirectangular frame retains the correct stereoscopic alignment as needed for the 16:9 3D frame. The crop box can be enlarged or reduced to meet creative requirements. Zero Parallax Distance (ZPD) can be adjusted to suit the requirements of a 16:9 3D screen. We used Magix Vegas Pro for this stage, from the 8K x 4K VR180 3D master.

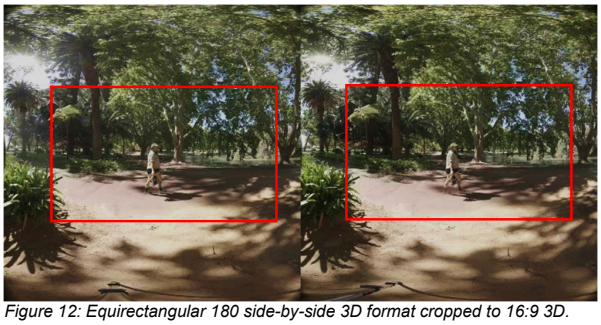

Figure 12: Equirectangular 180 side-by-side 3D format cropped to 16:9 3D.

Viewing the Film

The completed film can be viewed on a range of different types of display systems.

VR Headsets

Firstly, VR180 is viewable in all major VR headsets such as the Apple Vision Pro (Figure 13), the Meta Quest 3 (Figure 14) using suitable 3D playback software on these platforms.

Figure 13: Apple Vision Pro (Image: Apple)

Figure 14: Meta Quest 3 (Image: Meta)

HIVE Dome Display and HIVE Cylinder Display

The VR180 equirectangular file can also be viewed on the Curtin HIVE's 2D Dome display (Figure 15) and the HIVE 3D Cylinder Display (Figure 16).

Figure 15: The Curtin HIVE Dome display playing "Love Letter to Skating".

Figure 16: The Curtin HIVE 3D Cylinder display playing "Love Letter to Skating".

TVs and Projectors – 2D and 3D

The 16:9 version allows the film to be experienced by more viewers – albeit not in the fully immersive capability of VR180.

Gaussian Splatting

As part of the project Cass also experimented with creating a Gaussian Spatting experience (Figure 17). This wasn't integrated into the final short film – although it could have been. Instead, this output was created as a supplementary experience to the film.

Figure 17: Still frame from the Love Letter to Skating Gaussian Splat experience.

Conclusion

In conclusion, Cass has created a wonderful little 3D VR180 short film, which explores and explains her love of roller skating (Figure 18).

Hopefully you saw the 16:9 3-minute version of the film at the 3D Theater session on the Monday night of the 2025 Stereoscopic Displays conference. Additionally, the VR180 version was shown during the Electronic Imaging symposium Demonstration Session on an Apple Vision Pro and a Meta Quest 3. The film is also being shown on the festival circuit. If you haven't seen it already, hopefully you will get to see it soon.

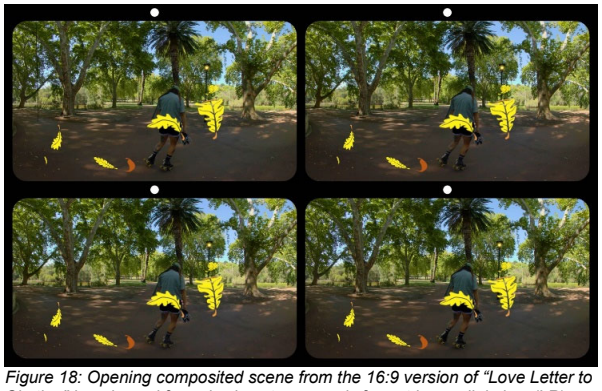

Figure 18: Opening composited scene from the 16:9 version of "Love Letter to Skating" in universal free-viewing stereoscopic format in parallel-view (LR) (top) and cross-view (RL) (bottom).

References

[1] C. Edwards, K. Ely-Harper, D. Adams, A. Rassel and A. Woods, "Immersive Cinematics: Redefining Traditional Narratives in VR180," Curtin HIVE internship report, Perth, Western Australia, 2024.

[2] M. Suto, "StereoMovie Maker FF," 2024. [Online]. Available: https://stereo.jpn.org/eng/.

Author Biographies

Andrew Woods is an Associate Professor at Curtin University where he manages the HIVE visualisation facility (Hub for Immersive Visualisation and eResearch) and is a Research Engineer at the Centre for Marine Science & Technology. He specialises in visualisation, stereoscopic 3D imaging, 3D reconstruction, 3D cameras and displays, video electronics, underwater vehicles (ROVs), and engineering software development, with applications in cultural heritage, maritime archaeology, and a wide range of other areas. He has BEng and MEng degrees in electronic engineering and his PhD was on the topic of crosstalk in stereoscopic displays. He is a senior member of IS&T.

Daniel Adams is a Computer Science graduate from Curtin University. His research experience has focussed on photogrammetric 3D reconstruction (P3DR) processing – particularly of wrecksites. He is currently a Research Officer on the ARC Linkage Project "Photogrammetric Reconstruction for Underwater Virtual Heritage Experiences" developing a P3DR pipeline to run on Pawsey Supercomputing Centre systems. He has worked on over 50 wrecksites to date and has specialised in producing 3D reconstructions from an eclectic range of underwater surveys.

Cass Edwards is a Gamilaraay woman based in Boorloo (Perth, Australia). She is a sports photographer and videographer working with some of the best athletes and brands in Australia. She has also worked on productions including Mystery Road. She is currently completing a Screen Arts degree at Curtin University in the School of Media, Creative Arts and Social Enquiry. At the time of this project she was an intern in the Curtin HIVE summer internship program.

Dr Kerreen Ely-Harper is a creative media researcher, filmmaker and educator. Her research interests are staging and performing personal stories, memory and trauma narratives on film, creative practice-led methodologies, creative practice in health and wellbeing settings, social storytelling and social media narratives. Media projects include short fiction, documentaries, corporate, dance film, virtual 3D digital texts. She is a senior lecturer in Screen Arts at Curtin University.

Dr Andrea Rassell is a filmmaker, media artist and researcher in science art. Working in nanoart — artforms that engage with nanoscience and nanotechnology — she creates experimental films and moving image installations that explore technological mediation and the perception of the nanoscale realm. She is a Forrest Foundation Creative Research Fellow at the Curtin HIVE.

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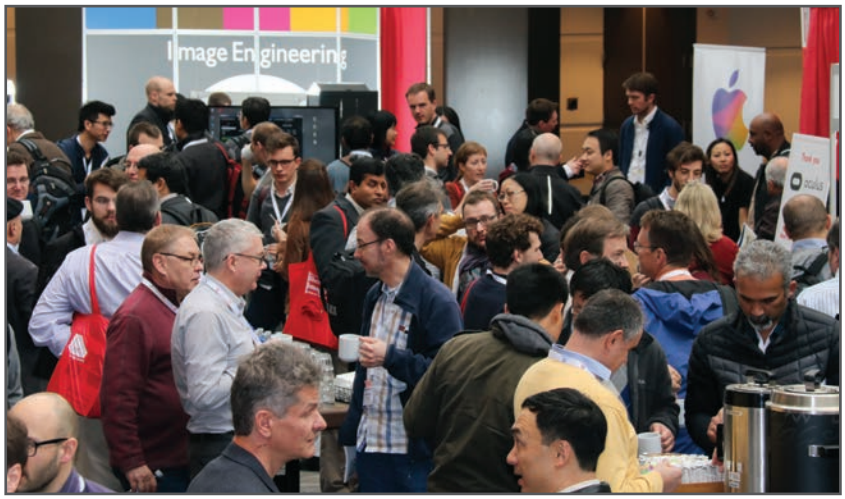

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