

Building an Animation Pipeline for VR Stories

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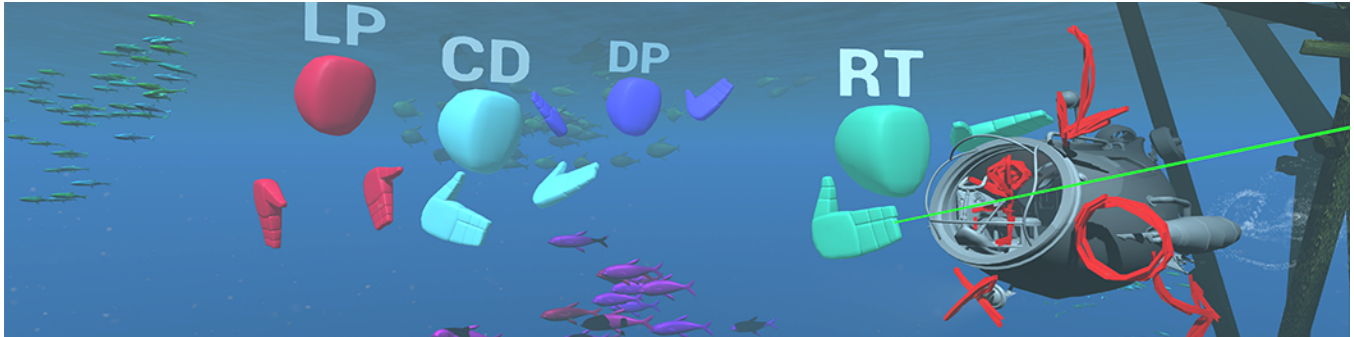


Figure 1: A screenshot from a networked animation review in virtual reality. ©2017, Penrose Studios, Inc.

ABSTRACT

Penrose Studios is an animation studio that produces content for VR and AR devices. There are a multitude of fascinating new artistic challenges facing animators and directors creating this type of content, such as animating without a fixed camera and very few cuts. Studios currently leverage existing animation and production tools to create content rendered in real time. However, this new medium is hampered by traditional processes that greatly reduce artist productivity and creativity. For instance, animating in traditional third party tools and importing into VR often leads to unexpected results, which results in a suboptimal iteration loop. We present a variety of tools that improve the traditional animation pipeline to address these issues and reduce the frequency of context switches between virtual reality and 2D monitors. The result is a toolset where artists feel empowered to explore animation in this new art form without being crippled by inefficient workflows.

CCS CONCEPTS

•Computing methodologies →Animation; Virtual reality;

KEYWORDS

virtual reality, animation, VR stories

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1 PREVIOUS WORK

There has been a variety of recent publications about the challenges of narrative animation in virtual reality. Baobab Studios has discussed the broad storytelling differences between traditional film and narrative VR experiences [Darnell and Hutchinson 2016]. Also, there has been a variety of talks on tools and workflows, such as for the clouds in *Allumette* [Penney 2016] and the VR drawing tool used to create *Dear Angelica* [Quilez 2016]. Little has been published on the improvements to the animation pipeline as a whole, from basic design principles, to creating blocking passes, and the review process. We strive to address these challenges to create higher quality animation more efficiently.

2 ANIMATION LAYOUT

The challenge of matching the scale of the VR viewer and the result seen from third party animation tools was predicted to be a large hindrance to the early stages of animation for an unannounced project. It features a character that operates in a mostly open area in which perceived scale is very important. Because there is no floor as a visual anchor, as there was in *Allumette*, the highly inefficient iteration loop for animation layout would have consisted of a process such as on the left side of figure 2.

We devised Dollhouse, a fully VR native animation layout tool that allows an animator to position assets in a scene, set keyframes,

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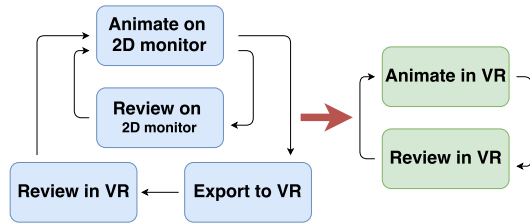


Figure 2: In blue, the old iteration loop with excessive context switches, and in green the simplified workflow with Dollhouse. ©2017, Penrose Studios, Inc.

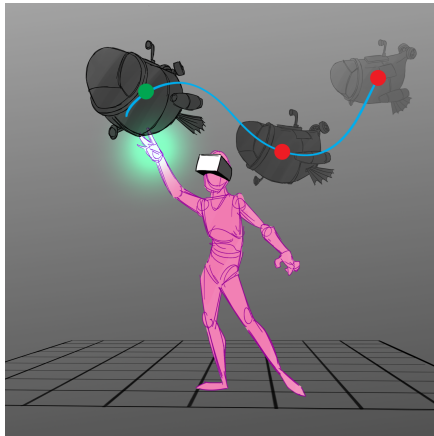


Figure 3: The user has created keyframes (in red) for a submarine, and is placing one at the green dot. The interpolated path is in blue. ©2017, Penrose Studios, Inc.

and playback the state of the animation. This allowed animators to work in a very natural and efficient way, and prevented the problems of animators previewing the work outside of VR.

3 DIRECTOR DAILIES

As with creating animated content in VR, directorial and artistic reviews carry similar context switching inefficiencies. Reviews were usually carried out with the director “in VR” using a headset, and the rest of the artists watching from “outside VR” on a 2D monitor. This resulted in a large perceptual disconnect between what the director and artists would see and subsequent difficulties in communicating notes in an environment where perspective matters a great deal.

To address these issues, we created Maestro, which is a cross-platform sequence management and network playback tool that allows any number of artists and directors to enter an experience together and review the content in VR. A standard set of review playback controls are supplied such as fast forward, rewind, and frame skip. Playback is controlled by a finite state machine, synchronized across all clients, meaning all reviewers inhabit the same story at the same playback state. In addition, we developed a variety of review tools, such as 3D drawing, laser pointers, and networked voice communication. Entering and exiting a networked review

session is a one-click process in the default development environment, ensuring that execution of a Maestro review is a lightweight process that can be utilized just as naturally as a traditional review.

Reviews are a social process that require the input of many people, including but not limited to the director. In a traditional process, participants can easily take control of playback with the keyboard of the playback machine. We needed to replicate this environment in Maestro, where any participant could take control of playback seamlessly. This created an edge case, where two people could issue the same command at the same time, leading to unexpected results and causing confusion during a review. Maestro is networked using finite state machines to control user actions and the world state. The world state, which controls the state of scene playback, implements a standard Lamport Clock [Lamport 1978], which prevents such conflicts.

4 DISCUSSION

We have many features planned for Dollhouse, including support for animating rigged characters, and better integration with third party applications. Ideally, we would embed our Dollhouse animation system in third party tools in a similar fashion to Houdini Engine [Xu and Campeanuy 2014]. We plan on adding better drawing tools and additional playback methods to Maestro. By producing this tool alongside production, we are able to react to the director’s and animators’ needs quickly and build a superior tool faster.

We have shown a variety of integral elements of an animation pipeline catering to the unique needs of narrative VR production. This set of tools and associated workflow has greatly improved the quality and efficiency of our animation to the point where no one at the studio even considers using traditional animation tools for blocking passes or non-networked review of new material.

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