Cinévoqué: Development of a Passively Responsive Framework for Seamless Evolution of Experiences in Immersive Live-Action Movies

Amarnath Murugan
IDC School of Design
Indian Institute of Technology, Bombay
amarnath.m@iitb.ac.in

Amal Dev
IDC School of Design
Indian Institute of Technology, Bombay
amaldv@iitb.ac.in

Jayesh S. Pillai
IDC School of Design
Indian Institute of Technology, Bombay
jay@iitb.ac.in

ABSTRACT

Cinematic Virtual Reality's (CVR) inherent feature of allowing the user to choose their Point of View (POV) within a 360° space brings forth new challenges to storytelling. The approaches used in traditional films do not translate directly to this medium, as it is uncertain if the user would follow all the Points of Interest (POIs) consistently. Our framework, Cinévoqué, aims to address this issue by using the real-time data generated during a VR film to passively alter the narrative and parts of the experience to suit the user's viewing behavior. In this poster, we discuss the technical approaches used to implement this framework and create responsive live-action CVR.

CCS CONCEPTS

• **Human-centered computing → Virtual reality**; *Scenario-based design*; *User centered design*; • **Applied computing → Media arts**; • **Computing methodologies** → *Virtual reality*.

KEYWORDS

Virtual Reality, VR Cinema, Storytelling, Responsive Narrative, Presence

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1 INTRODUCTION

Cinematic Virtual Reality (CVR) immerses the viewer within a virtual environment of the movie and provides them with the ability to choose their own Point of View (POV). This feature makes it difficult to guarantee that the viewer's POV would always align with the storyteller's intended Point of Interest (POI), unlike non-immersive films, where information pertaining only to the POIs are visible in the rectangular frame. Thus, viewers may not be able to infer a coherent narrative in CVR if they fail to follow the intended POIs. Filmmakers and Researchers have tried to work around this issue through the use of audio and visual cues [Pillai et al. 2017; Rothe et al. 2017] to direct the viewer's attention to the intended POI. They have also utilized specific design approaches such as keeping POIs of successive scenes in a similar viewing direction to make it easier for the viewer to follow them [Brillhart 2016]. Though these approaches could help mitigate the problem to an extent, they can't warrant that all viewers would look at the intended POIs.

We propose a passively responsive framework named Cinévoqué that acts as a backend for CVR, which would dynamically alter the movie experience unbeknownst to the viewer based on POIs the user has looked at or missed, in order to show a narrative that's consistent with what they have seen. Though, to the viewer, the experience would be similar to watching a normal VR movie. As an extension to this approach, it is also possible to implement alternate storylines that are entirely different from each other, of which one would be shown to the viewer based on their gaze behaviour and without any conscious inputs from them. While the concept of branching storylines have been used in real-time games and interactive experiences, wherein the content is programmed to react based on the player's actions, the challenges in implementing this is in the context of CVR is made unique by the immutable nature of recorded or rendered videos. In the following sections, we discuss the approaches used to develop a framework that enables the creation of passively responsive experiences that account for this problem.

2 SYSTEM IMPLEMENTATION

Cinévoqué is a portmanteau of the words 'cinéma' and 'évoqué' that indicates our concept of 'evoked cinema' and it is a system built within the Unity3D game engine. The films that run on this framework are composed of *nodes*, which are snippets of the possible narrative paths. These nodes are connected in a directed graph structure and are segregated under different *levels* based on the part of the narrative they represent, i.e., nodes that depict alternate scenarios beyond a single point in the narrative are grouped under a single level. The structure of a simple Cinévoqué film is shown in Figure 1. Nodes are named after their position within the storyline, and the nomenclature is given by *L(level number)N(node number)*.

The decision to traverse a particular node from its alternatives is predominantly influenced by the user's passive interactions with entities called *hotspots*. They are usually associated with the intended POIs in an immersive scene, both spatially and temporally,

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and hold certain conditions, which when met, dynamically alter the experience for the user. The extent of these changes could vary from the whole storyline to the spawning of additional audio or visual elements within a node.

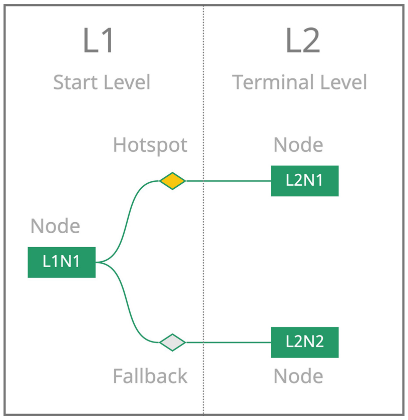

Figure 1: Basic Narrative Structure in Cinévoqué [Pillai et al. 2019]

Cinévoqué's underlying 3D scene structure is composed of a camera placed at the center of two concentric spheres on which the equirectangular video clip of each node is projected. The sphere visible to the camera is denoted as the 'Inner Sphere' and the other sphere is marked as 'Outer Sphere'. As a viewer traverses through the narrative, these spheres alternate in terms of rendering order between successive levels, so that the video clip of the successive node can be loaded into memory in the background and played onto the outer sphere during a transition.

When implementing branching narrative structures in an immersive movie, frequent jumps between video clips through the use of cuts while altering the narrative path may lower immersion. Our framework tries to address this problem by using multiple transition styles that make the change in video clips seamless or relatively less noticeable. In consecutive nodes where there is spatial and action continuity for the same POI across nodes, the framework uses a feathered wipe transition that starts in the direction of the viewer's gaze. When there's spatial continuity but no continuity of POIs across nodes, the transition is executed by hiding the part of the inner sphere that is not seen by the viewer while the outer sphere is playing the succeeding node's video, then directing their attention to the visible part of the outer sphere, at which point the inner sphere is hidden completely and switched in the render queue to become the outer sphere. To further improve the seamlessness of these transitions, additional spheres with masked images or videos could be rendered on top of the inner sphere and made to persist across levels. For instance, in our prototype, *Schrödinger's Vada-Pav* [Pillai et al. 2019] equirectangular pictures of a swivel chair and body were added on top of the inner sphere, thereby reducing the visual area that is susceptible to change during transitions between nodes with spatial continuity. A similar approach could be taken with regards to audio; a separate audio source could be placed within the framework that plays the ambient noise to ensure audio continuity across nodes.

The integration of a real-time framework with CVR allows us to make changes to the audio-visual elements in an experience dynamically to a certain extent. In the case of *Schrödinger's Vada-Pav*, the spheres that renders the swivel chair and body mentioned above rotate to align with the viewer's physical body. Depending on the platform, the data used to facilitate this feature could be just the gaze information or the rotation data from a 6DOF controller attached to the physical chair (highlighted in Figure 2). Furthermore, actively collected user data such as name could be integrated within the movies to personalize the experience, *Schrödinger's Vada-Pav* implements this feature by displaying a notification within the movie that contains the viewer's name. Similarly, the framework could be extended to provide responsiveness beyond the storylines by spawning or modifying additional audio or visual elements based on real-time data.

Figure 2: HTC Vive setup for *Schrödinger's Vada-Pav*

3 CONCLUSION AND FUTURE WORK

Cinévoqué has been primarily evaluated through two of our prototypes *Schrödinger's Vada-Pav* and *Shapeshifter* [Pillai et al. 2019]. Though both experiences incorporated the major technical elements of the framework, they had certain drawbacks such as lack of stereo 3D and relatively simple narrative. In order to test the framework with a more complex narrative, we are working on "Till We Meet Again". In this film, the viewer experiences one of the eight potential storylines in stereo 3D with ambisonic audio. The narrative structure consists of 4 levels, 15 nodes, and 11 hotspots which utilize all the transition styles of the framework and also include the extended features such as rotating virtual chair.

In summary, we have described the features of a responsive system for live-action CVR that would help maintain coherence in the narrative shown to the user based on their gaze behaviour.

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