Editing Immersive Recordings: An Elicitation Study

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(a) Viewer placement

(b) Collaborative review

(c) Optional transitions

Figure 1: Editing techniques proposed by experts: (a) defining viewer placement and size, (b) collaborative review with support for the creation of comments, and (c) optional transitions which inform the viewer of the new position through a portal.

ABSTRACT

Immersive recordings capture virtual reality interactions and are used in various contexts such as education and entertainment. However, there has been only limited research on requirements and techniques for editing such recordings. We interviewed expert editors of video recordings to understand their workflows, familiarised them with immersive recordings, and asked them about what editing challenges and capabilities they can envision for immersive recordings. The experts identified several functionalities they considered relevant for editing, including viewer placement, control over the viewer's size, support for live and asynchronous collaboration, and different transition types.

CCS CONCEPTS

- Human-centered computing \rightarrow Interactive systems and tools.

KEYWORDS

Virtual Reality, Immersive Recordings, Immersive Editing

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1 INTRODUCTION

Immersive recordings capture interactions in virtual reality (VR) and enable their playback in VR. They are being used in many different contexts, e.g. in education [5], entertainment [2], asynchronous collaboration [3], and analysis [1]. They enable captivating and immersive viewing experiences by allowing observations of recorded content from any point within the virtual environment (VE) [6]. The importance of editing capabilities for such recordings has been emphasised [3], as recordings may lack relevant content, may contain flaws or irrelevant content, and may be viewed from any point in the VE. Yet, despite this, research on the requirements and techniques for editing such recordings is only limited.

To address this gap, we conducted semi-structured interviews with experienced video editors to explore their current workflows, frequently used functionalities, and common editing challenges. We familiarised the experts with immersive recordings and engaged them in brainstorming sessions to understand the challenges and functionalities they envision for editing immersive recordings in VR. Additionally, we discussed their opinions on the potential advantages and disadvantages of editing in VR.

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Our contributions include: (1) the investigation of editing workflows and challenges faced by professional video editors, and (2) the identification of novel functionalities for VR editing systems based on expert feedback, including techniques for curation, flexible editing, and collaboration support. These insights will inform the design of future VR editing systems by addressing the needs of editors to enhance the overall immersive experience.

2 PROCEDURE

For investigation, semi-structured interviews were conducted, transcribed, and analysed thematically. The interview comprised three parts: (1) exploring editors' workflows, frequently used functionalities, and common editing challenges; (2) familiarising experts with immersive recordings and engaging them in a brainstorming session to explore the curation of the viewing experience, editing techniques, and support for collaborative processes; and (3) discussing experts' opinions of potential advantages and disadvantages of editing in VR. For familiarisation, experts were presented with a 2:34-minute recording of an interaction between actors via various media: 2D on a desktop PC, 360° VR, immersive VR with automatic teleportation to viewpoints, and immersive VR with independent navigation. Camera viewpoints were consistent across the 2D, 360°, and VR (automatic teleportation) versions (see Figure 2).



Figure 2: Overview of the actors' movements (coloured lines) as well as the viewer placement (blue circles). The viewpoint order is indicated through the number at each viewpoint.

3 RESULTS

Two experts [E1,E2] with extensive professional experience in editing video recordings (E1 > 18 years, E2 > 30 years) participated in our interview.

3.1 Editing Workflows

Common steps in their workflow include getting an overview of the material, selecting, sorting and shortening recordings and aligning visuals and music. Frequently used editing functionalities are cuts [E1, E2], text insertion [E1], visual effects [E1], colour correction [E2], and slow motion [E2]. A common challenge is the lack of suitable footage due to not recorded content or limited camera perspectives. Important software functionalities include the support of

undo operations [E1], auto-save [E1] and audio visualisations [E2]. Collaboration can take place through live feedback from directors [E2] or written comments [E2].

3.2 Demo Feedback

Experts found the automatic VR teleportation transitions to be disorienting [E1] and emphasised the importance of guidance to relevant content [E1, E2]. Conversely, independent navigation was found to increase spatial awareness [E1]. It was noted that the medium has an influence on how the content is processed, e.g. as more time is needed to perceive the environment [E2].

3.3 Proposed Functionalities

In the brainstorm session, experts proposed different functionalities for curating the viewing experience, editing and collaborative work.

Curating the viewing experience: Experts suggested to inform viewers about upcoming transitions [E1, E2]. For guidance, the use of vignettes [E1], outline effects around relevant objects [E1], arrows towards important content [E1] and a portal view to relevant content [E2] were suggested. Experts proposed defining points of interest [E2] and modifying the viewer size [E2]. Different transition types were discussed, including optional previews which provide viewers with a preview and the option to accept the transition [E2].

Editing functionalities: To allow for more flexible editing control, experts proposed applying editing operations independently to individual objects or groups [E1], trajectory-based editing [E1] and re-enactment in slow motion [E1]. Experts agreed that editing in VR is necessary to preview the experience correctly but raised concerns that it could be cumbersome or difficult [E1]. Hybrid Desktop-VR approaches were suggested to allow for accurate editing [E1, E2].

Collaboration support: Support for asynchronous collaboration was considered important, and functionalities for creating comments and supporting shared live review were proposed [E2].

4 FUTURE WORK

We plan to involve additional experts, including professional 3D animators, to include a more diverse perspective on editing immersive recordings. Future research should investigate to what extent findings on transitions [4] and group navigation [7] in VR can be transferred to the viewing experience of immersive recordings. We believe that the investigation of techniques that allow an efficient overview of immersive recordings is important for future systems, as it is an essential part of the editing workflow. Likewise, the support for asynchronous collaboration should also be explored, particularly how comments can be linked to relevant content and viewpoints in the scene. In addition, the acceptance and impact of optional transitions on immersion and presence should be investigated.

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