

Social Viewing in Cinematic Virtual Reality: Challenges and Opportunities

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Abstract. Cinematic Virtual Reality (CVR) has been increasing in popularity in the last years. However, viewers can feel isolated when watching 360° movies with a Head-Mounted Display. Since watching movies is a social experience for most people, we investigate if the use of Head Mounted Displays is appropriate for enabling shared CVR experiences. In this context, even if viewers are watching the movie simultaneously, they do not automatically see the same field of view, since they can freely choose the viewing direction. Based on the literature and experiences from past user studies, we identify seven challenges. To address these challenges, we present and discuss design ideas for a CVR social movie player and highlight directions for future work.

Keywords: Cinematic Virtual Reality, 360° video, social viewing

1 Introduction

360° movies are attracting widespread interest in a number of applications, like education, entertainment and news. Users highly benefit from the possibilities to freely look around and explore the presented scenes, either to entertain themselves or to gain a better understanding of the movie content.

In Cinematic Virtual Reality (**CVR**) viewers watch 360° movies via Virtual Reality (VR) devices. By using an HMD, the viewer can feel immersed within the scenes and freely choose the viewing direction. In contrast to traditional cinema or TV, each CVR viewer has an own display and gets isolated of the surrounding environment when watching a movie via HMD. The drawback of these systems is the associated visual and mental separation from other people, i.e. social isolation. Natural discussion, like pointing at interesting objects in the video or keeping the awareness about what the others focus is on, is impeded by the HMD.

In this work, we identify key challenges and related design aspects that are crucial for efficiently supporting social awareness and interaction when watching movies together remotely. We provide an overview of the current research state and identify seven open challenges. While further challenges may exist, these seven challenges are important for a first design approach. For each of these challenges, we propose potential approaches and future work directions.

2 Challenges and Approaches for Social Viewing in CVR

2.1 Challenge 1: Viewport Sharing

One of the main problems for social viewing via HMDs is the difference of the users' FoV and the missing awareness of the other's viewport. Being unaware of where co-watchers are looking at within the 360° scenes can lead to difficulties of understanding. A first approach is to **frame** the viewport of the co-watcher [1]. So, the viewport is visible, if the viewports are overlapping (Fig. 1 left). For finding the viewport of the co-watcher, which is off-screen, an arrow can be used [1].



Fig. 1. Approaches to show the viewport of a co-watcher. Left: Viewport shown by a frame; Right: Viewport shown by a display

Another approach is the **picture-in-picture (PiP)** method [2], where a little screen shows the co-watcher's FoV (Fig. 1 right). This has the advantage of visually showing the other's viewport, independent on the own viewing direction, but the disadvantage of covering a larger area of the display. So, the possibility of switching it off should be explored. The PiP-screen can be placed on that display side which is closer to the target.

2.2 Communication

A key issue in social viewing is the communication. In CVR the viewer does not know where the others are looking at. Why is he or she laughing? How can a viewer indicate details in the movie which are not necessarily in the FoV of the other viewers?

Voice chat is one possibility to communicate in social viewing. Although voice chat increases the social awareness [3], it can reduce the viewing experience because of distraction. Chatting could be replaced or extended by a simple **sign language** realized by gestures or controllers, to show emoticons to the co-watcher.

To inform the co-watcher about **PoIs** out of the screen, we plan to transfer methods used by gliders for collision avoidance. An example is shown in Fig. 2 left. The slide bar at the bottom shows if the PoI is on the right or on the left side. The slider on the right shows if the PoI is higher or deeper than the own viewing direction. Another example can be seen in Fig. 2 right, where the direction is shown by a circle and the height by a slider. In this way, participants will be able to distinguish between viewport awareness and signalling a PoI.



Fig. 2. Collision avoidance methods of gliders transferred to indicate the PoIs of the co-watcher. Left: The PoI is on the left side behind the viewer, below the viewing direction; Right: The PoI is on the left side behind the viewer, below the viewing direction.

2.3 Social Awareness

Another challenge for social viewing via HMDs is to provoke the feeling of “being together”. Watching a movie together in the cinema or TV, the fellow is perceived in the periphery of the view. Even though “silent” feelings cannot be heard, they can be recognized by postures or gestures.

Voice chat and visualization of the co-watcher’s viewport enable awareness of the other persons. Another way for increasing the social awareness is to include video chat windows via PiP. Figure 3 shows two examples. In the left one, the front-view of the co-watcher is displayed in the middle of the screen, even if the viewer turns the head. The right one is very similar to the situation of viewing a movie together in cinema or TV. The PiP is placed on the side of the viewer and shows the co-watcher from the side.



Fig.3. Left: PiP of the co-watcher in front of the viewer. The co-watcher is always in the FoV; Right: PiP of the co-watcher on the side. The co-watcher can be seen, turning the head right.

2.4 Synchronization/Navigation

Synchronization of the media playout across the involved devices is a key requirement in social viewing [4, 5]. By providing this, all distributed users will perceive the same events at the same time. This involves designing and adopting the appropriate communication and control protocols, monitoring algorithms, reference selection strategies and adjustment techniques. Likewise, media synchronization must be preserved after issuing navigation control commands (e.g. play, pause, seek) in a shared session.

2.5 Input Device

For navigation as well as for communication, non-disturbing input methods need to be adopted. We think **graphical elements** on the display or controlling via **speech** disturb the viewing experience. One approach is to use **gestures**, because gestures are a natural method for interaction [6]. Other approaches are head/view-based, and controller-based methods. In [7] some of these methods were compared, head and controller-based methods achieving the best results, since there were some problems in gesture recognition. For our first test we used **controllers** to be sure the actions were triggered on purpose.

2.6 Role Concept

To define the relation between the viewers, two role concepts are conceivable: non-guided and guided. The **non-guided** approach is based on assigning the same roles and permission to all viewers. This can originate conflicts in case of highly active communications. Likewise, the display can become overloaded when information about all users is shown. The **guided** approach consists of differentiating two roles: the guide and the follower. The guide will be taken as the reference for communication and synchronization and will be the only participant with the navigation functionalities enabled. To allow more interactive and flexible sessions, the roles of guide and followers can be dynamic exchanged. A **slave** mode, where the follower is synchronized in time and viewing direction to the guide, causes simulator sickness [8]. However, it can be a helpful in asymmetric environments with non-VR collaborators.

2.7 Asymmetric Environments

Social viewing should also be possible for participants using different devices. Gugenheimer et. al [9] implemented ShareVR, which enables users of the real world to interact with users in a virtual world. They studied asymmetry in visualization and interaction. A novel social viewing concept is considered in [10], consisting of a multi-screen scenario in which different users play a different role: observer (TV), assistant (tablet) and inspector (HMD). The inspector's viewport is streamed to the TV to allow the remaining users being aware of the 360° scenes, thus overcoming isolation and stimulating interaction. This and the guidelines in [9] will be taken into account in our work.

3 Conclusion and Future Work

In this work, we have identified and addressed key challenges to enable social viewing in CVR. For a shared experience, viewers need new methods of communication and viewport awareness. The field of social viewing in CVR is relatively new and it needs more research and knowledge about the viewers' behaviour. The described approaches are one step to explore this field. Based on this work, we will compare the approaches among other relevant aspects. The aim is to define a design space for social CVR.

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