

Coordinating Attention and Cooperation in Multi-user Virtual Reality Narratives

Cullen Brown* Ghanshyam Bhutra† Mohamed Suhail‡ Qinghong Xu§ Eric D. Ragan¶

Texas A&M University, United States of America

ABSTRACT

Limited research has been performed attempting to handle multi-user storytelling environments in virtual reality. As such, a number of questions about handling story progression and maintaining user presence in a multi-user virtual environment have yet to be answered. We created a multi-user virtual reality story experience in which we intend to study a set of guided camera techniques and a set of gaze distractor techniques to determine how best to attract disparate users to the same story. Additionally, we describe our preliminary work and plans to study the effectiveness of these techniques, their effect on user presence, and generally how multiple users feel their actions affect the outcome of a story.

Index Terms: H.5.1 [Information interfaces and presentation]: Multimedia Information Systems—Artificial, augmented, and virtual realities

1 INTRODUCTION

A great deal of work has been done experimenting with storytelling using head mounted displays (HMDs) and virtual reality (VR), with recent examples of immersive stories including Oculus Story Studios “Henry”, Jon Favreau and Wevrs “Gnomes and Goblins”, and Google Spotlight Stories’ “Help”. Creators are exploring new ways to engage viewers while allowing freedom of view control, but most immersive stories are primarily designed for a single user. In this work, we explore methods for guiding and coordinating multiple users in interactive stories tailored for multiple active viewers using separate immersive displays. We aim to study how the collaboration between users might enhance or hinder feelings of user presence in the environment or engagement with the narrative.

2 PRIOR WORK

The study of VR storytelling involves understanding narrative structures, the sense of agency and presence, and multi-user interactions in virtual environments.

2.1 Narrative Structure in Virtual Reality

A fair amount of research has been done in studying the narrative structure of mixed reality stories. A common theme in these works is that traditional, passive storytelling paradigms are insufficient for telling meaningful stories in virtual environments. Some blame the issue on the nature of diegetic storytelling (storytelling entirely through narration) and mimetic storytelling (telling a story through recreating events) both relying on the passivity of the listener or viewer [1]. Other works determine this issue while trying to compare mixed reality storytelling to existing storytelling paradigms,



Figure 1: A screenshot from our multi-user story. Two users attempt to play over a network connection.

like audience participatory theater [2] or traditional cinematography [3]; the former found greater success in focusing on emulating the active parts of participatory theater, and the latter found eschewing the continuities of time, space, and action typical in traditional film-making in favor of active character interaction more conducive to telling stories in a virtual environment.

2.2 Agency and Presence

In addition to studying the effect of different narrative structures in virtual storytelling environments, a number of authors have also studied issues of agency and user presence within said environments. Fencott [4] addressed how many virtual story experiences rely on intentional user action to drive story progression. They discussed how this allows gameplay experiences and storytelling experiences to intermingle instead of acting as isolated parts. One work illustrates this by recreating a scene from Madame Bovary, in which the user’s carries the story along through dialogue with a virtual actor playing the titular Madame. The user’s choices of dialogue with a virtual actor causes the narrative to shift [5]. Additionally, Oculus Story Studio has commented on how lack of agency in the world can be harmful to user presence, such as when the viewer is not acknowledged by virtual characters or when they are acknowledged but can not interact or impact the narrative [6].

2.3 Multi-User Virtual Environments

As far as multi-user interaction in virtual environments is concerned, while little research has been done in the realm of storytelling, a fair amount of work has been done in other fields. Much of this work focuses on collaboration and communication between users (e.g., [7]). Other researchers looked at the effectiveness of communication models in remotely connected virtual environments, finding that technical aspects of the communication are less important for enhancing productivity than cultivating a shared sense of presence [8]. Research has also looked at the effectiveness of guidance in multi-user virtual environments and how it affects the ability of users to learn [9]. Lastly, Fairclough and Cunning-

*e-mail: cullen.brown@tamu.edu

†e-mail: gbhutra@tamu.edu

‡e-mail: mohamedsuhail@tamu.edu

§e-mail: qinghx39@tamu.edu

¶e-mail: eragan@tamu.edu

ham's work discussed maintaining multiple parallel storylines for multiple users in a shared virtual environment [10].

3 IMMERSIVE COLLABORATIVE STORY

To study collaborative multi-user narratives in virtual reality, we created a comprehensive story experience in which the actions of multiple users drive narrative progression. In our story "The Cave", multiple users enter a virtual cave to help a young mother find her missing child before it is eaten by monster. Users are expected to be able to speak with one another (naturally if they are co-located or via remote speech).

Our story is told in three parts; a passive introductory phase, an active exploration phase, and a passive conclusion phase. We believe this split allows us to utilize both existing narrative structures and take advantage of the virtual environment as a storytelling device. In both the introductory and conclusion phases, users are free to look about a scene as they are either introduced to the plot and the world or are told how their actions affected the world in the end. In the interactive phase of the experience, users are tasked with finding the missing child in one of many paths extending out from a central cave. We use either a set of gaze attracting techniques (discussed in the following sections) to help the users find the missing child and to draw focus to predefined story elements. Based on the players success in finding the child within a given time limit, the conclusion of the story will display one of two endings, with conditional dialog from the mother actor based on their actions (e.g., "I cant thank you enough for your help!" or "Why arent you helping? I brought you here to help!")

Our story is rendered in Unity 5 and rendered on two machines remotely connected over a wireless network. Each computer has an attached Oculus Rift headset for immersing the user in the virtual environment, and users were provided an Xbox One controller to navigate. Some graphics and sounds within the virtual environment were collected from a number of open-source and free asset sources, each credited at the end of the story.

3.1 Attracting Attention in Multi-User Narrative

Early on, we encountered the issue of deciding how to advance the plot in a virtual setting; namely, if two users are provided the freedom to move and act in the virtual space, then how do we attract one or both participants' focus to story events in the environment? We decided to use two methods of shifting user gaze to those events: guided camera techniques, and voluntary distractor techniques.

3.1.1 Camera Techniques

Taking inspiration from existing film techniques, we decided on two guided camera techniques to redirect participant gaze to story events. The first is a direct scene transition: the camera fades out and then fades back in with the event in the center of a participant's field of view. The other technique is a forced camera rotation: the user camera rotates independently of the user to face the event taking place. While effective and straightforward for adjusting the camera view, we expect this technique to be disruptive and disorienting for users. Experimenting with such techniques will allow us to take a directorial role in the story.

3.1.2 Distractor Techniques

The study of distractors to influence viewing is not to VR (e.g., [11]). In our story, we are experimenting with both visual and auditory types of distractors. The visual distractor takes the form of a firefly that drifts into a user's field of view and flies off screen in the general direction of the active story event. If the user rotates to follow the firefly, it will remain in their field of view until the user can see the story event taking place. Should the user choose to ignore the firefly, it will re-enter the user's gaze and repeat this action until it is noticed. Auditory distractors take the form of sounds in

the environment relatively near to the event taking place. We assume users will hear the distractors and turn to face them. These techniques will allow us to suggest action to the user without forcing it on them.

3.2 Evaluation Plan

We are planning a study to compare our gaze attraction techniques and to address a number of questions. First, we want to see whether or not distraction techniques or camera techniques are necessary for drawing user attention to a story, or if the story itself is sufficient to attract user attention. Second, we want to study which of the two sets of techniques best draw user attention without damaging their sense of presence and their engagement in our narrative. Third, we aim to see if our narrative promotes collaboration and cooperation, and to what extent this helps the users achieve the central goal (finding the missing child). Fourth, we would like to determine how, should one user find the child alone, the user who does not find the child feels and how their presence is affected. Lastly, in the case of an uncooperative player (one who does not work towards meeting the goal), we would like to determine whether the active player feels their experience was hindered or cheapened by the lack of collaboration. We will be collecting qualitative data on user experience during the study via observing user actions and noting dialogue between users and after the study via a structured exit interview.

4 CONCLUSION

We created a virtual story environment to study storytelling with multiple active viewers and methods of directing user gaze in a shared narrative. We developed two pairs of redirection techniques, including a set of guided redirection techniques and voluntary gaze distractors. We plan to conduct a study to better understand the effectiveness of our techniques within the multi-user VR narrative.

REFERENCES

- [1] R. Aylett and S. Louchart, "Towards a narrative theory of virtual reality," *Virtual Reality*, vol. 7, no. 1, pp. 2–9, 2003.
- [2] N. Braun, "Storytelling in collaborative augmented reality environments," 2003.
- [3] A. Clarke and G. Mitchell, "Film and the development of interactive narrative," in *International Conference on Virtual Storytelling*, pp. 81–89, Springer, 2001.
- [4] C. Fencott, "Virtual storytelling as narrative potential: Towards an ecology of narrative," in *International Conference on Virtual Storytelling*, pp. 90–99, Springer, 2001.
- [5] M. Cavazza, J.-L. Lugin, D. Pizzi, and F. Charles, "Madame bovary on the holodeck: immersive interactive storytelling," in *Proceedings of the 15th ACM international conference on Multimedia*, pp. 651–660, ACM, 2007.
- [6] M. Burdette, "The swayze effect." <https://storystudio.oculus.com/en-us/blog/the-swayze-effect/>, November 2015.
- [7] C. R. Paris, E. Salas, and J. A. Cannon-Bowers, "Teamwork in multi-person systems: a review and analysis," *Ergonomics*, vol. 43, no. 8, pp. 1052–1075, 2000.
- [8] C. J. Knudsen, "Video mediated communication (vmc)-producing a sense of presence between individuals in a shared virtual reality," in *Proceedings of International Symposium on Educational Conferencing*, 2002.
- [9] B. C. Nelson, "Exploring the use of individualized, reflective guidance in an educational multi-user virtual environment," *Journal of Science Education and Technology*, vol. 16, no. 1, pp. 83–97, 2007.
- [10] C. Fairclough and P. Cunningham, "A multiplayer case based story engine.," in *GAME-ON*, p. 41, Citeseer, 2003.
- [11] T. C. Peck, H. Fuchs, and M. C. Whitton, "Evaluation of reorientation techniques and distractors for walking in large virtual environments," *IEEE Transactions on Visualization and Computer Graphics*, vol. 15, no. 3, pp. 383–394, 2009.