Children Do Not Play War:

Gaze-Based Interaction in Cinematic 360 VR

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Figure 1: Campfire Scene – interactive hot-spot over Aloyo character (left); Reticule indicating Gaze direction (center).

CCS CONCEPTS

• **Computing methodologies** → *Virtual reality*; • **Human-centered computing** → *Interactive systems and tools.*

KEYWORDS

Lord's Resistance Army, Children Peace of Uganda, VR for Good

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1 INTRODUCTION

This project is part of the Oculus VR for Good Creators Lab program. It started in 2017 with the selection of Fabiano Mixo by VR for Good Creators Lab 2.0. This initiative pairs filmmakers with nonprofit organizations to create transformative VR experiences that promote social changes in breakthrough ways. This resulted in a partnership of VILD Studio, an emerging film and XR production company running by the filmmaker, with GO Campaign, an organization for improving the lives of orphans and vulnerable children around the world. Subsequently, VISGRAF Laboratory, a media research group, joined them forming a collaborative effort to develop new tools for the production of an interactive stereoscopic 360 film.

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2 THE FILM

Children Do Not Play War is a cinematic Virtual Reality tale of the war in Uganda told through the eyes of a young girl [2].

Aloyo, a twelve years-old girl living in Lira, Uganda, sits among other children around the fire to tell their story during war, what they saw, where they went. Mixing early oral storytelling tradition and contemporary Virtual Reality narrative, blending fiction and non-fiction elements, CHILDREN DO NOT PLAY WAR narrates the memories, dreams and daily lives of the children who returned from the war and about how they recovered their childhood. The film makes use of interactive elements to immerse the viewer in Uganda's quest for redemption, hope, and healing.

Over decades, at least 60,000 children were abducted from their villages by the Lord's Resistance Army (LRA) and forced to become soldiers or soldiers wives in a violent guerrilla war across Uganda and Central Africa. Some children spent more than their entire youth marching through the bushes.

All the characters in CHILDREN DO NOT PLAY WAR suffered directly or indirectly the consequences of war, facing stigmatization and prejudice for having been soldiers or, like our narrator Aloyo, for being born in captivity. They are now under the care of Children of Peace Uganda (CPU) and Go Campaign, organizations who provide humanitarian aid for war-affected children.

Their story take place in rural Northern Uganda, in one of CPU's farms where through financial, social and psychological assistance the children learn to become themselves again. Their tale is highlighted by the music of Opira Morise Kato, an Acholi songwriter who composed and played his songs with instruments made by himself, and who was also one of the many children who escaped the LRA rebels. He sings about childrens education, rehabilitation and world peace.

3 THE TOOLSET

360 VR Gaze-Based Interaction is a platform for creation of interactive omnidirectional cinematic content for Virtual Reality. The system is implemented as a Unity package (See [1]). It was developed for the Children Do Not Play War project. But, future plans include the release as a general authoring framework on the Unity's Asset Store.

3.1 Gaze-Based Interaction

The interactive mechanisms for 360-degree VR films, because of their very nature, demand a gaze-based type of interaction, such that the viewer center of interest guides the narrative.

The basic mechanism can be divided into two main elements: Gaze Detection; and Gaze Action. They are used to create interaction objects, such as the Hotspot.

3.1.1 Gaze Detection, Gaze Action and the VR Interactive Item . Gaze Detection provides support for tracking the viewer direction and identifying the object in the scene which the user is looking at.

The implementation of Gaze-Detection resorts to a VR Camera. The camera should be located at the center of the video sphere.

The Gaze Action consists of the abstract element that implements the interaction events for 360 VR.

The VR interactive Item embodies a general component that is used for communication between Gaze Detection and Gaze Actions in the interaction mechanism.

3.1.2 The Hot-Spot. Uses the Gaze Action mechanism in order to provide interactivity to the VR narrative. Essentially, it defines a Region of Interest (ROI) of the viewing sphere that, when looked at, potentially creates an interaction event.

The Trigger initiates the interaction event of a Gaze Action. The Hot-Spot object monitors the time interval that the viewer direction is inside its ROI Rectangle. When this wait time expires the Gaze Action is triggered.

3.2 Non-Linear Storytelling

Interactive 360-degree films feature a narrative-based audio-visual experience. Moreover, they rely on a non-linear storytelling structure to allow the viewer explore the content. In that respect, the time dimension is the fundamental ground for building the film.

The 360 VR Gaze-Based Interaction platform employs the Unity Timeline as the basis to create non-linear narratives for virtual reality.

The Unity Timeline is a structure containing a set of Tracks that control various Game Objects through time. A Track, in turn, is composed of Clips that span a time interval and guide the events and actions which are in effect during that particular period of time.

3.2.1 Interaction Track. The interactivity for Cinematic 360 VR narrative is mainly built on top of a Gaze Interaction Track. The Gaze Interaction Track has as its primary purpose to provide means for creating non-linear narratives based on the viewer's gaze direction.

3.2.2 Clip Types. The elements for controlling the non-linear flow of the narrative are track Clips. They are the building blocks to alter the sequential time-evolution based on interaction events. As such, they collectively implement the language idioms for interactive storytelling.

The Gaze Interaction Clip types currently implemented are described below with their respective functionality and parameters. Clip names are intuitive and auto-explicative.

- Marker: identifies a time instant in the timeline;
- Player; activates the playback of an audio or effect;
- Jumper: changes the current time to the location of a marker;
- Spotter: implements a hot-spot for audio playback;
- Trigger: triggers an action of an interaction object;
- Timer; starts a time-dependent jump to a marker;
- Choicer; controls a jump to one of a set of markers, depending on programmable interaction behaviour.

Note that some Clip types have markers as parameters. These markers correspond to particular time-instants in the Timeline and they provide the basic mechanism for jumping through time in a non sequential manner.

Other Clip types are associated to a Game Object. These objects are responsible for the implementation of interaction events. The fact that they are general Game Objects makes possible to develop different kinds of interactions based on content and narrative.

3.2.3 Interaction Objects. The interaction game objects connect with the clips of the gaze interaction track to perform actions based on narrative interactivity. They usually have as one of its components a VR Interactive Item. This is the general API for controlling the actions of the object. So far, we have implemented three interaction objects: Audio Source; Gaze Rotation and Gaze Marker Selector, that are described below:

- Audio Source: controls audio playback. It is useful for voice-over, music, ambient noise and many other sound-related effects.
- Gaze Rotation: changes the VR camera direction (i.e., viewer's gaze) to a different location in the panoramic image domain.
- Gaze Marker Selector: selects a marker label based on a procedural criteria. It is used in combination with the Choicer Clip type.

3.2.4 Interaction Idioms. The combination of Gaze Interaction Clips defines the idioms in the language of non-linear interactive narratives. Below we list some of the idioms that have been created within the context of Cinematic 360 VR.

- Jumper + Marker;
- Spotter + Player + Marker;
- Trigger + Player;
- Timer + Jumper + Marker;
- Choicer + Markers;

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[1] Luiz Velho. 2019. *Interactive 360 VR.* Technical Report TR-01-2019. VISGRAF Lab - IMPA.
[2] VILD Studio. 2019. Children Do Not Play War. http://www.vildstudio.com/cdnpw.