# Gaze-Based Interaction in Cinematic 360 VR

Luiz Velho

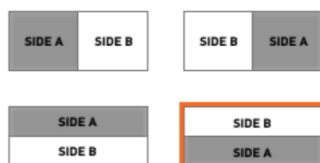IMPA

# Outline

- Cinematic 360 VR

- Gaze-Based Interaction

- Non-Linear Storytelling

- Media Authoring

- Case Study

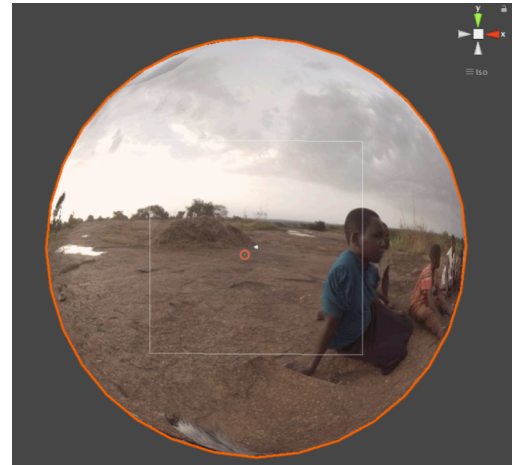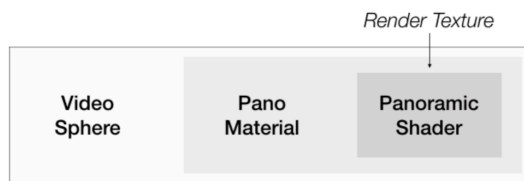# Cinematic 360 VR

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# Omnidirectional Video

- Equirectangular Format
  - Latitude / Longitude Parametrization

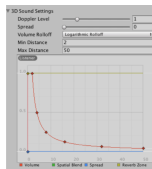- Stereoscopic Layout

# *360 Video Player*

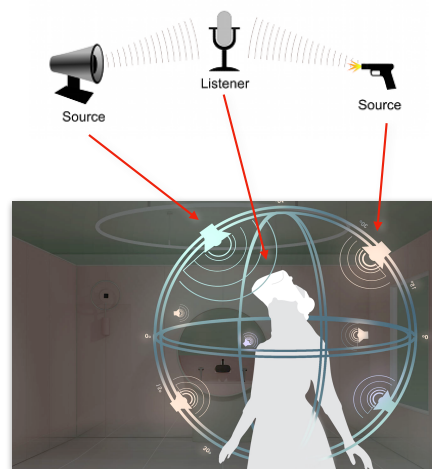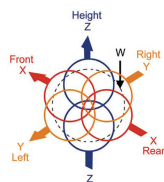- Texture Map to Sphere

- Skybox / Panoramic Shader
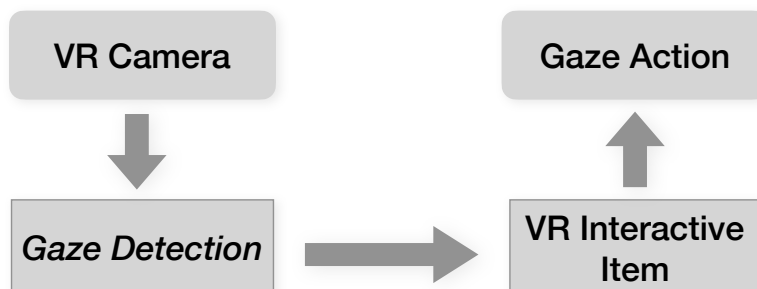




# Spatial Sound

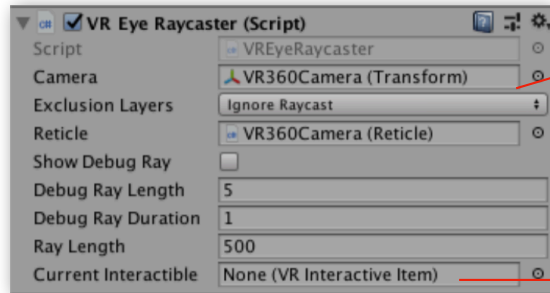- 3D Sound



- Ambisonics Format

# *Gaze-Based Interaction*

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# Interaction Mechanism

- Flow of Control

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┌─────────────────┐              ┌─────────────────┐
│   VR Camera     │              │   Gaze Action   │
└─────────────────┘              └─────────────────┘
         │                                ▲
         ▼                                │
┌─────────────────┐          ┌─────────────────────┐
│ Gaze Detection  │ ───────▶ │  VR Interactive     │
│                 │          │       Item          │
└─────────────────┘          └─────────────────────┘
```
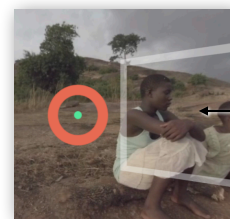
# *Gaze Detection*

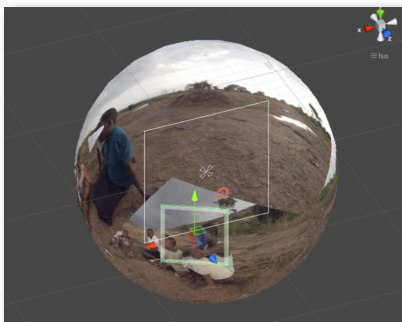- VR Eye Raycaster



VR Camera


ROI

VR Interactive Item

# The Hot-Spot

- Creates Interaction Event





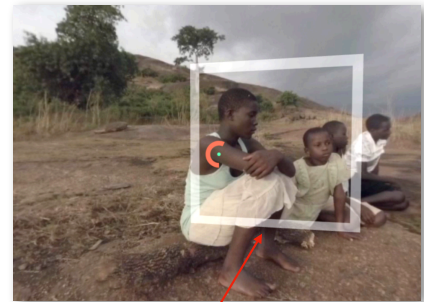ROI Rectangle

# Gaze Action

- Action Trigger



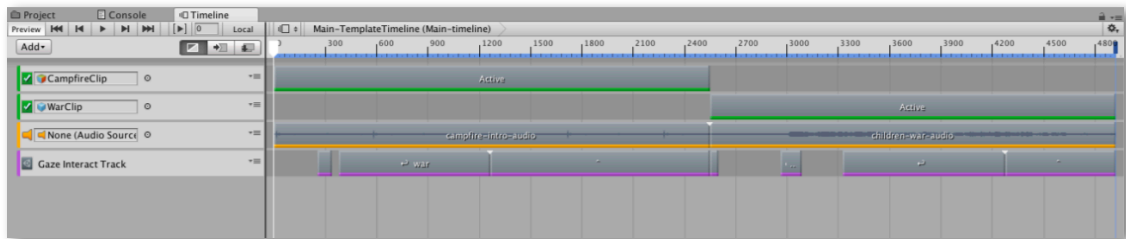Button
Box Collider
**VR Interactive Item**

**Hotspot Button**



**Box**

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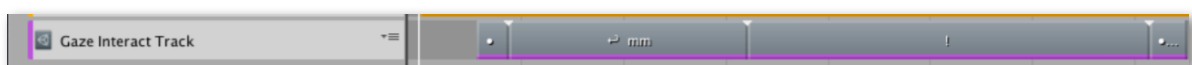
# Non-Linear Storytelling

# Timeline

- Narrative Structure



**Tracks**

**Clips**

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# *Time-Flow Control*

- Playable Director



- Gaze Interaction Track
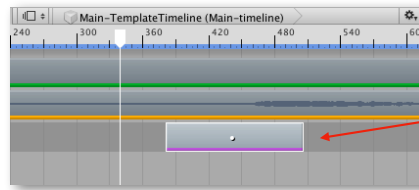  - Non-Linear Narratives
  - Viewer's Gaze Direction
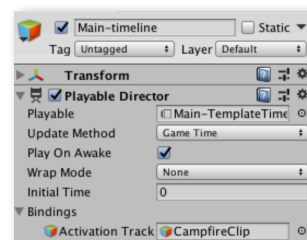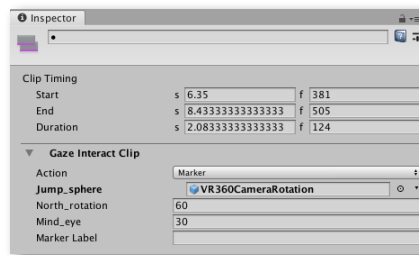
# Clips

- Clip Element (Gaze Track)

- Clip Types (Gaze Interact)
  - Marker
  - Player
  - Jumper
  - Spotter
  - Trigger
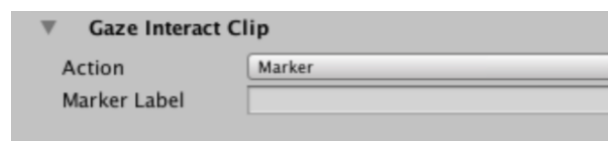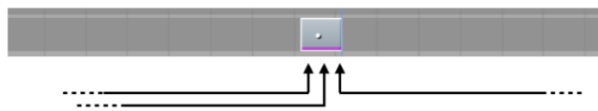  - Timer
  - Choicer

**Clip Object**

**Clip Parameters**

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# *Marker*

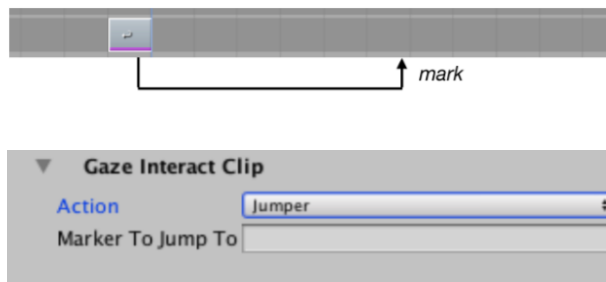- Identifies a Time Instant in the Timeline

# *Player*

- Activates Playback of Audio or Effect



# *Jumper*

- Changes Current Time to Marker Location

# *Spotter*

- Implements Hot-Spot for Audio
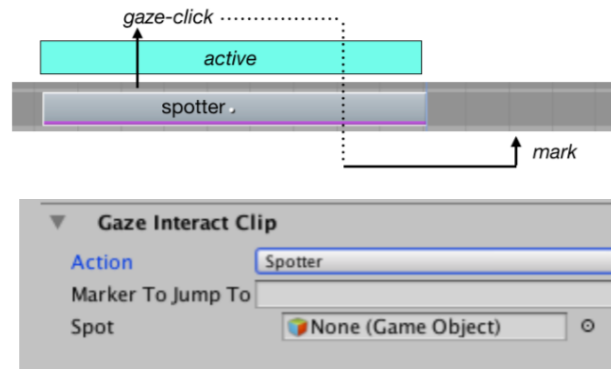


# *Trigger*

- Triggers an Action of Interaction Game Object
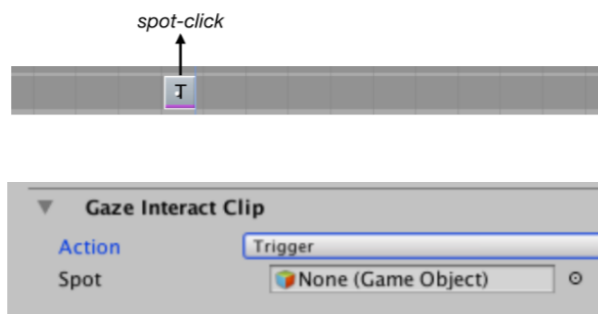
# *Timer*

- Start Time-Dependent Jump to a Mark



| Gaze Interact Clip | |
|---|---|
| Action | Timer |
| Marker To Jump To | |
| D Time | 0 |

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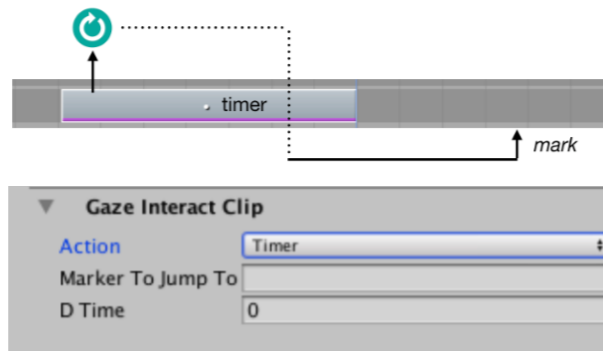
# *Choicer*

- Controls Jump to Element of a Markers Set (*based on interaction behaviour*)



| Gaze Interact Clip | |
|---|---|
| Action | Choicer |
| Spot | None (Game Object) |
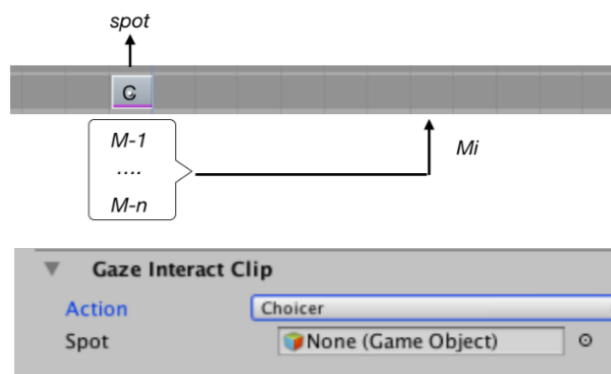
# *Media Authoring*

# Interaction Objects

- Perform Action Based on Narrative Interactivity

- Connect with Clips of the Gaze Interaction Track

- Incorporates a VR Interactive Item Component


- Basic Interaction Objects
  - Audio Source
  - Gaze Rotation
  - Gaze Marker Selector

# Audio Source



- Controls Audio Playback

- Used for
  - Voice-Over
  - Music
  - Ambient Noise
  - Sound Effects
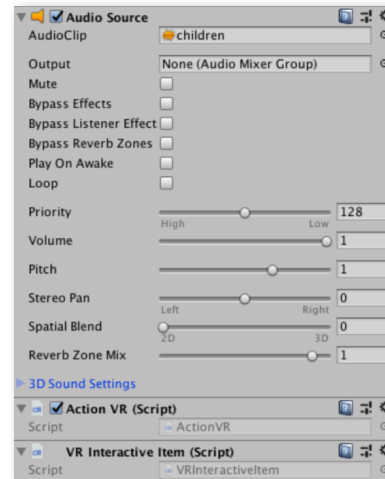
# Gaze Rotation



- Changes the VR Camera Direction

- Cut Viewer's Gaze
  - Location in Panoramic Image

# *Gaze Marker Selector*

- Selects a Marker Label
  - Based on Procedural Criteria
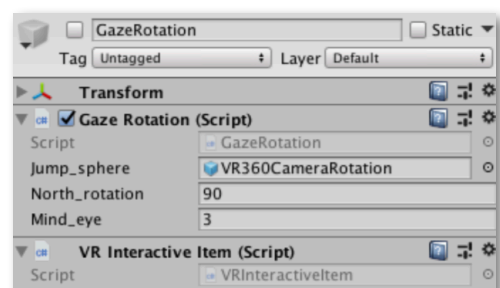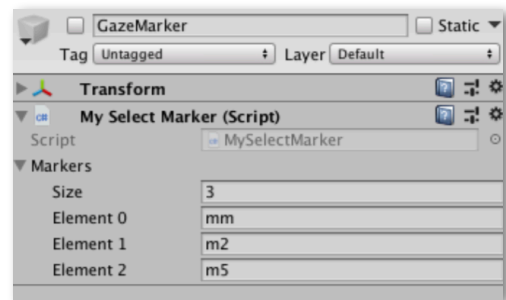
- Used in Combination with Choicer Clip

| | | | |
|---|---|---|---|
| ☐ GazeMarker | | | ☐ Static ▼ |
| Tag Untagged | | Layer Default | |
| ▶ ⚒ **Transform** | | | 🔲 🎛 ⚙ |
| ▼ ⓒ **My Select Marker (Script)** | | | 🔲 🎛 ⚙ |
| Script | MySelectMarker | | ○ |
| ▼ Markers | | | |
| Size | 3 | | |
| Element 0 | mm | | |
| Element 1 | m2 | | |
| Element 2 | m5 | | |

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# Interaction Idioms

- Language of Non-Linear Interactive Narrative

- Defined by Combination of Gaze Interaction Clips

- Some Useful Idioms
  - Jumper + Marker
  - Trigger + Player
  - Spotter + Player + Marker
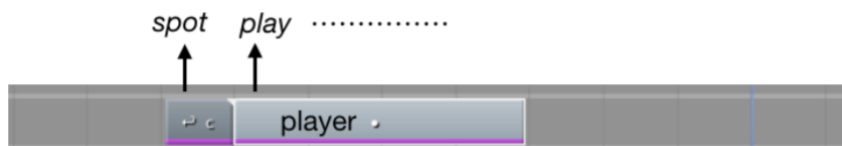  - Timer + Jumper + Marker
  - Choicer + Markers

# Jumper + Marker
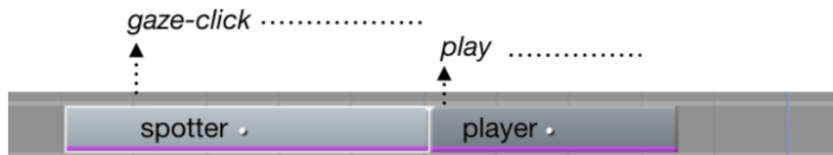
- Skip to a Different Time
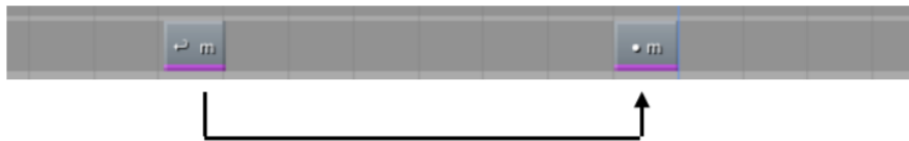


# Trigger + Player

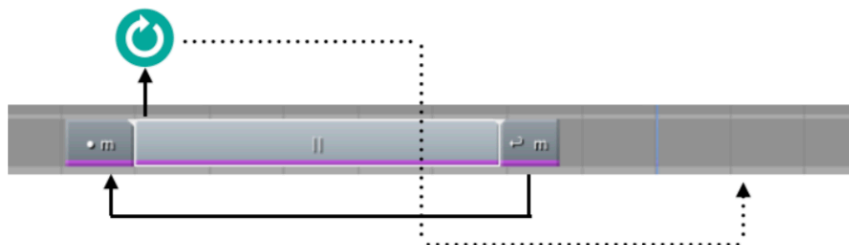- Gaze-Based Play of Game Object

# *Spotter + Player + Marker*

- Selective Temporal Play of Alternative Audio Clips



# *Timer + Jumper + Marker*
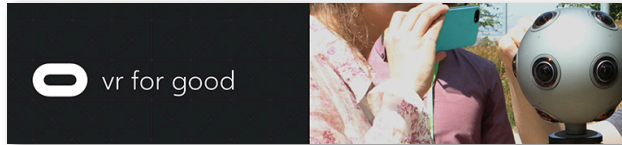
- Loop in a Sequence until Time Expires

# Choicer + Markers

- Jump to Selective Time Locations



# Case Study

# Context



- Oculus / Facebook



Creators Lab

Creators Lab from Oculus VR for Good pairs rising filmmakers with nonprofits to use the power of VR to tell stories and help people around the world better understand each other. Through VR, we aim to bring greater awareness to challenges people face globally.

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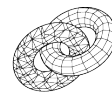# Searching for Aloyo

- 2017 Creators Lab 2.0 Program

- Partnership



Filmmaker



Nonprofit



VisgrafLab

Research

- Synopsis

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.

# Children Do Not Play War



# *Image Effect*

# Video Effect



# Audio Effect

# SIGGRAPH 2019

- Computer Animation Festival / VR Experience / Tech Report



# Meta Store



VR for Good

## Children Do Not Play War