Panoramic Views into The Future

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Outline

• One Bit of Futurology
• Some Concepts and Theory
• State of the Arts & Craft

Past, Present and Future

• Yesterday:
  • Where do we come from?
• Today:
  • Things that are happening…
• Tomorrow:
  • What will come next?

The Big Picture

Film / Video

VR

AR

Games

convergence / integration

BTW, SIGGRAPH 2016

Electronic Theatre

VR Village

Emerging Tech

Real-Time Live!

Content, Modes and Users

<table>
<thead>
<tr>
<th>Story</th>
<th>Passive</th>
<th>Many</th>
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<td>Exploration</td>
<td>Interactive</td>
<td>Individual</td>
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<td>Role Playing</td>
<td>Engaging</td>
<td>Groups</td>
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CG & Animation

Production Pipeline

Technology Trends

Cameras

Displays

The Dream Camera
We are Getting There…

announced Oct. 2015

Ideal Display

- Stereo 3D / Holographic
- Viewpoint Aware
- Tone Mapped HDR
- Retina High-Res
- Space Embedded
- Zero Latency

Dilema!

Are Theatres Doomed?

Multiple Scenarios / Platforms …

What are people doing?

- Oculus Storyboard Studio
- ILMxLab
- Blender Animation Studios

What are people doing?

- VR Storytelling
- Oculus HMD

latest project

- Immersive Entertainment
  - Lucasfilm Content (Star Wars / Jurassic Park)
- Various Platforms

Stereo VR
HMD
Tablet
Blender Animation Studios

- New Production Tools

Caminandes: Episode 3 - Xmas VR

Ongoing Project…

Challenges

- New Media
  - Language
  - Authoring
- Production
  - Representations
  - Tools

Research @ VISGRAF

- VR - 360° Video
  - Camera Language
  - Extended Panoramas
- AR - Stereoscopic Immersion
  - Mesa 3D
- Media Integration
  - Blender Multi-View Tools

360° Video

Field of View

- Reference to Observer
  - 30 to 90 degrees

Film Language

- Conventional Cinema
  - HD Television
  - Theater / Panavision
- 360 Degrees Cinema
  - Omnimax / Full Dome
  - HMD
  - Tablet
Conventional Cinema

• Camera Moves Language

.Track Pan / Tilt Zoom

360° Camera

• Camera Moves Language

.Track Pan / Tilt Zoom

Yes Maybe

360° Image Transforms

Moebius Transformations for Manipulation and Visualization of Spherical Panoramas

• Current Research at VISGRAF Lab
• Collaboration with
  - Leonardo Koller Sacht (PhD Student)
  - Luis Penaranda (Post-Doc)

Möbius Transformations

• Complex Map $M : \mathbb{C} \mapsto \mathbb{C}$

Math of Camera Moves

• Omnidirectional Images and Möbius Transformations
  - Pan / Tilt $\leftrightarrow$ Elliptic Transform
  - Zoom $\leftrightarrow$ Hyperbolic Transform
  - Perspective $\leftrightarrow$ Parabolic Transform

Transformation Pipeline

• Möbius Mapping

Transformation Pipeline

- Möbius Mapping

- Möbius Mapping

- Möbius Mapping
Example

- Extreme Zoom

Augmented 360° Panoramas

Photorealistic Rendering of Omnidirectional Images, combining Real and Synthetic Scenes

- Current Research at VISGRAF Lab
- Collaboration with
  - Aldo Zang (PhD Student)
  - Dalai Felinto (Research Assistant)

HDR RGB-D Panorama

- Radiance
- Depth

Environment Model

- Derived Data:
  - Scene Geometry
  - Light Map

CG Integration

- Blender Plugin
Synthetic Objects

- Insertion into the Scene

Augmented Reality

- Full Simulation of Real-Virtual Interaction

Photorealistic Rendering

- Blender to LuxRender

Fish Eye Output

- Cycles

Stereoscopic Immersion

Full panoramic rendering of the scene
Mesa 3D

*Interactive Horizontal Stereoscopic Display*

- Current Research at VISGRAF Lab
- Collaboration with
  - Dalai Felinto (Research Assistant)
  - Bruno Madeira (PhD Student)
  - Djalma Lucio (Research Staff)

Planovision

- Horizontal Oblique Projection
- Viewpoint Tracking
- Embedded Augmented Reality

Media Integration

Current / Future Research

- Authoring Systems
  - Integrated Media
  - Natural Interfaces
- Production Techniques
  - Live Action + CG
  - Real Time Simulations

Authoring Issues

- Passive
  - Movies
- Interactive
  - Google Street View
- Immersive
  - AR Cinema

Emerging Medias
Blender VR

*Integrated Multi-View and Stereo 3D*

- Current Research at VISGRAF / Blender Institute
- Collaboration with
  - Dalai Felinto (Research Assistant)
  - Aldo Zang (PhD Student)
  - Djalma Lucio (Research Staff)

Media Integration

- Blender VR

VISGRAF Studio Setup

Panoramic Projection  HMD - Oculus

Mesa 3D  Optitrack

*LIMSI-CNRS*

*to be continued…*