

Panoramic Views into The Future

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VISGRAF Lab - IMPA

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?*

Past

Film / Video

Present

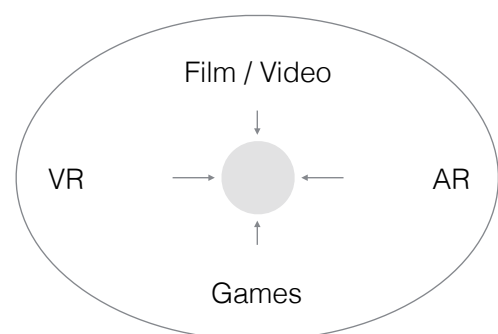
Film / Video

VR

AR

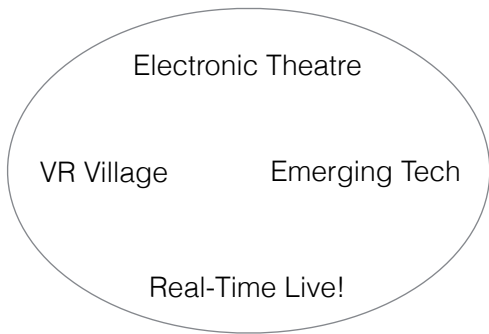
Games

Future



convergence / integration

BTW, SIGGRAPH 2016



Content, Modes and Users

Film / Video	Story	Passive	Many
VR / AR	Exploration	Interactive	Individual
Games	Role Playing	Engaging	Groups

CG & Animation

Film / Video	2D Images	Single Camera
VR / AR	3D Geometry	Multi-View
Games	Behaviour (4D)	Autonomous PV

Production Pipeline

Film / Video	2D / Compositing	Off-Line
VR / AR	3D / Rendering	Real-Time
Games	Simulation / AI	Concurrent

Systems & Technologies

Film / Video	VFX / Post	Displays
VR / AR	Assets / Worlds	Input / Output
Games	Rules / Engines	Location Aware, Networked

Technology Trends

- Input
 - Cameras
 - Sensors
 - Output
 - Displays
 - Sound
- } dependencies

Cameras

- RGBD
 - Zed / Kinect / Tango
- Omnidirectional
 - PointGrey Ladybug / KodakSP 360
- Plenoptic
 - Lytro Immerge

Displays

- Full Dome
 - IMAX
- HMD (Head Mounted)
 - Oculus / Google Cardboard
- Light Field
 - MS HoloLens / NVIDIA Projects
- Tablets, Etc..

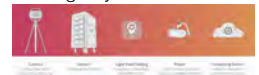
The Dream Camera

- 360 Degrees
- Depth
- HDR
- A-Res
- Noiseless
- Robotic

We are Getting There...



Immerge System



announced Oct. 2015

The Lytro logo is centered on a light orange-to-white gradient background. The logo consists of a stylized camera lens above the word "LYTRO" in a bold, sans-serif font, with the letter "O" colored in orange.

Ideal Display

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

Dilema!



individual

or



group

?

- Are Theatres Doomed?
- Multiple Scenarios / Platforms ...

The Light Field Stereoscope: Immersive Computer Graphics via Factored Near-Eye Light Field Displays with Focus Cue

Fu-Chung Huang Kevin Chen Gordon Wetzstein

Stanford University



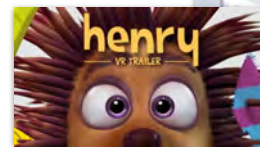
What are people doing?

- Oculus Storyboard Studio
- ILMxLab
- Blender Animation Studios

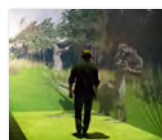
oculus storystudio

- 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

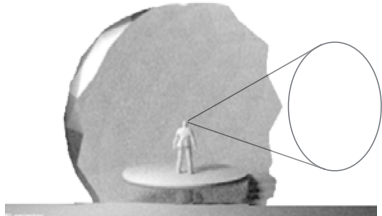
Research @ VISGRAF

- 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

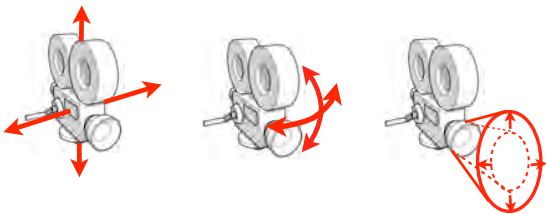
Conventional Cinema

- Camera Moves Language

Track

Pan / Tilt

Zoom



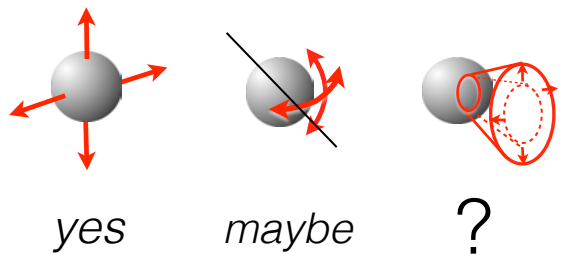
360° Camera

- Camera Moves Language

Track

Pan / Tilt

Zoom



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)

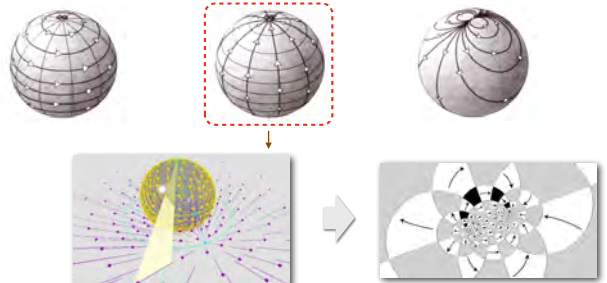
Möbius Transformations

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

elliptic

hyperbolic

parabolic

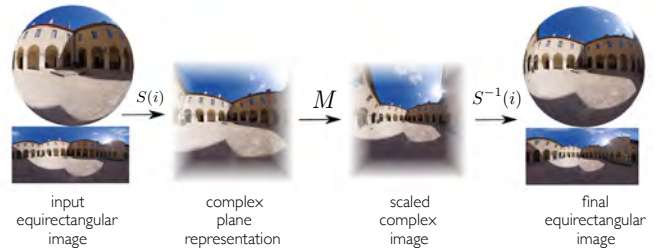


Math of Camera Moves

- Omnidirectional Images and Moebius Transformations
 - Pan / Tilt \Leftrightarrow Elliptic Transform
 - Zoom \Leftrightarrow Hyperbolic Transform
 - Perspective \Leftrightarrow Parabolic Transform ?

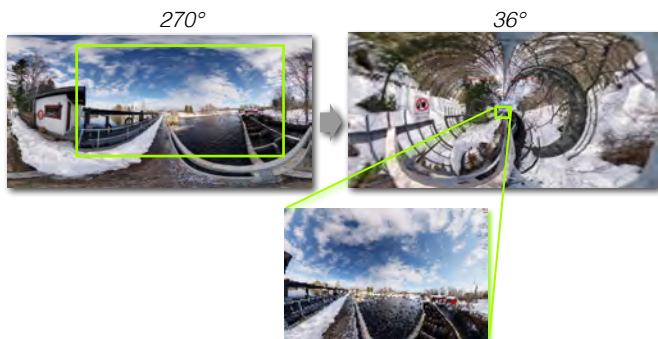
Transformation Pipeline

- Möbius Mapping



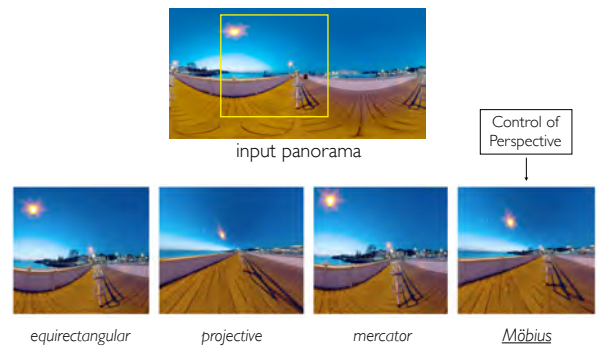
Example

- Extreme Zoom



Comparison

- Alternative Projections



Augmented 360° Panoramas

Photorealistic Rendering of Omnidirectional Images, combining Real and Synthetic Scenes

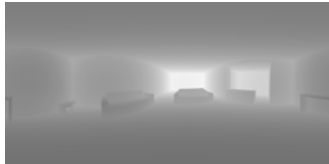
- Current Research at VISGRAF Lab
- Collaboration with
 - Aldo Zang (PhD Student)
 - Dalai Felinto (Research Assistant)

HDR RGB-D Panorama

- Radiance

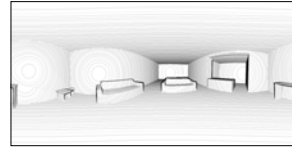


- Depth

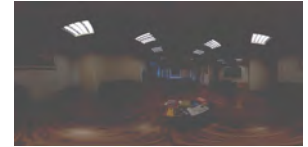


Environment Model

- Derived Data:



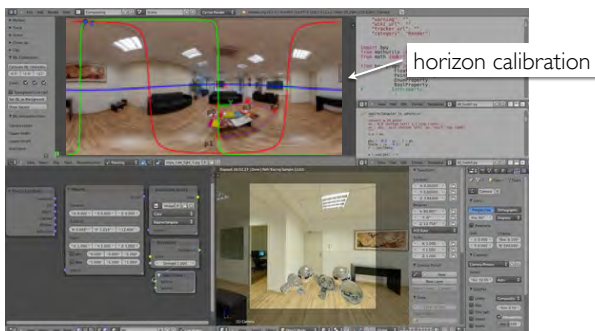
Scene Geometry



Light Map

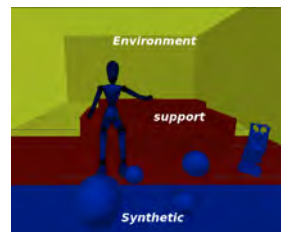
CG Integration

- Blender Plugin



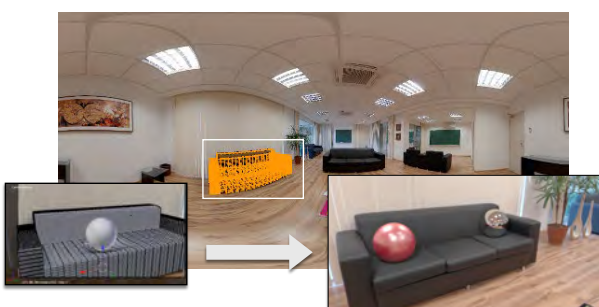
Synthetic Objects

- Insertion into the Scene



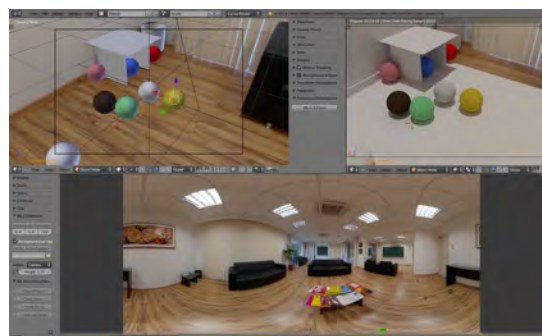
Augmented Reality

- Full Simulation of Real-Virtual Interaction



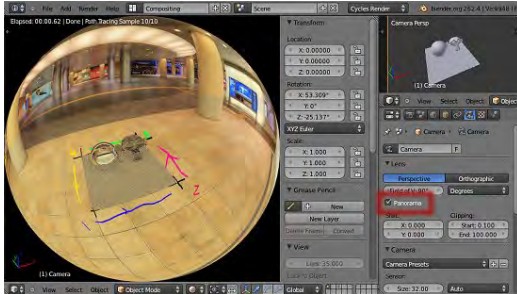
Photorealistic Rendering

- Blender to LuxRender



Fish Eye Output

- Cycles



Full panoramic rendering of the scene

Stereoscopic Immersion

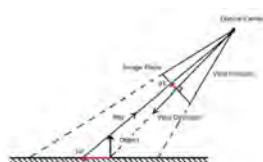
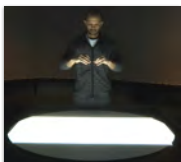
Mesa 3D

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

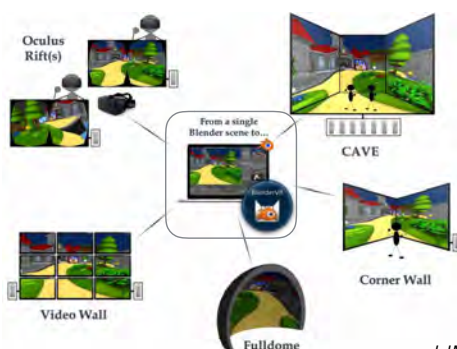
Blender VR

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)

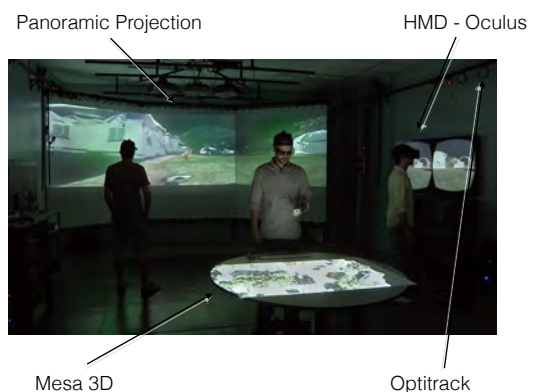
Media Integration

- Blender VR



LIMSI-CNRS

VISGRAF Studio Setup





to be continued...