Current Topics in Virtual Reality

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Agenda

- Presentation of the Virtual Reality Group
- Seminar organization
- Seminar topics

Virtual Reality Group

The Visual Computing Institute @ RWTH

- Founded in October 2015 within the Fachgruppe Informatik
  - Creation …
  - Processing …
  - Presentation …

} … of visual (or visualizable) information

Computer Graphics Group
Prof. Leif Kobbelt

i8

Computer Vision Group
Prof. Bastian Leibe

LuFG i8

VR & Immersive Visualization Group
Prof. Torsten Kuhlen

LuFG i12 & IT Center

Mesh Generation Group
Prof. David Bommes

AICES

www.vci-rwth-aachen.de

~ 60 scientists
~ 25 students

Computer Animation Group
Prof. Jan Bender

LuFG i8

What is Virtual Reality all about?

I³

- Navigation
- Manipulation

... in real-time!

- 3-D & multimodal
  - visual
  - acoustic
  - haptic/tactile
  - proprioceptive

Seminar Organization

General Information

All details given on the seminar‘s web page
http://www.vr.rwth-aachen.de/course/13

- 3 weeks time to drop out without consequences (2017-05-12)
- All templates on web page
- All dates on web page
- Failing a deadline = failing the seminar
- Written and oral part need to be passed

- Do not hesitate to contact your advisor!

Process

- Literature research and Outline
- First Submission
- Final submission
- Rehearsal talk
- Final presentation

Literature Research & Outline

- Primary paper handed out by your advisor
- Self-responsible investigation of this material and background information
  - Training „Literaturrecherche“
  - Sources: Internet, Library, ..

- **List of references & outline (deadline: 2017-05-15 8:00am)**
  - Key to getting your thesis set up
  - Fill the given template:
    - List all related papers that you deem relevant
    - Add a short explanation
    - Give an outline with short explanations

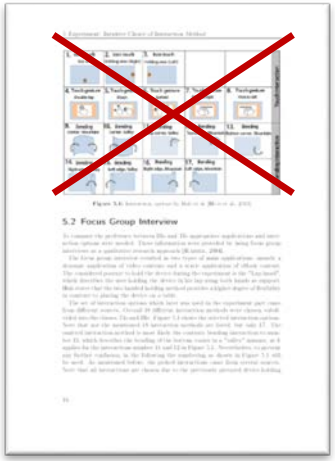
Writing the Seminar Paper

- Prepare a detailed discussion of your topic
  - Methods, techniques, and algorithms presented in the primary paper
  - Work closely with your advisor

- The paper
  - Includes: figures, tables, references, …
  - LaTeX template on web page (DIN A4, 12pt font size, single-spaced line pitch)
  - **16-21 pages (text)**

1 page

3/4 page



1/2 page

Writing the Seminar Paper

- Citations and Plagiarism
  - All external, i.e., not your own results must be labeled correctly
  - Applies for seminar paper and the presentation

- First submission:
  - **Complete** sumission of your paper
    - 16-21 pages
    - Figures, references
    - Understandable and complete content
    - Minumum grade 4.0
  - Not fulfilling **all** of these conditions = failing the seminar

- Deadlines:
  - **First version: 2017-06-19 8:00am**
  - **Final submission: 2017-07-14 8:00am**

Presentation

- Present your topic for your peers
  - Introduction to problem domain
  - Introduction to problem itself
  - Solutions for the problems
  - Concentrate on the „nuggets“ of your paper

- 20min presentation + 5min discussion

- Deadlines:
  - **Rehearsal talk till: 2017-07-21**
  - **Final presentation: 2017-07-27 9:00am-5:00pm**

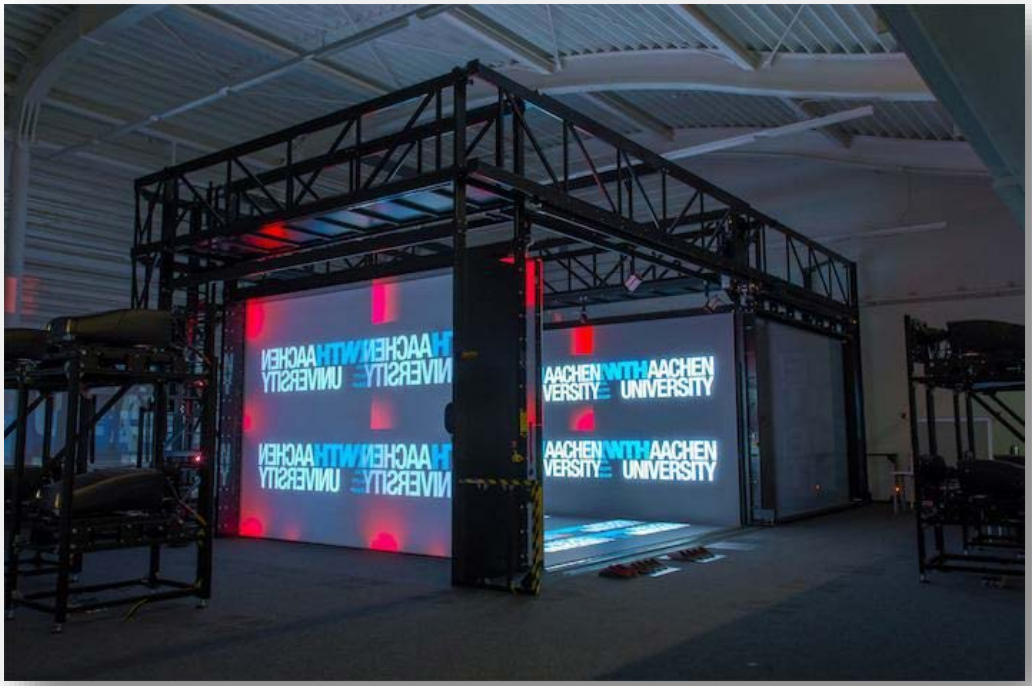
Deadlines

- Deadlines are hard
- Failing one deadline = failing the seminar

- Literature research/Outline: 2017-05-15 08:00am
- First submission: 2017-06-19 08:00am
- Final submission: 2017-07-14 08:00am
- Rehearsal talk till: 2017-07-21
- Final presentation: 2017-07-27 9:00am-5:00pm

VR Lab Demo

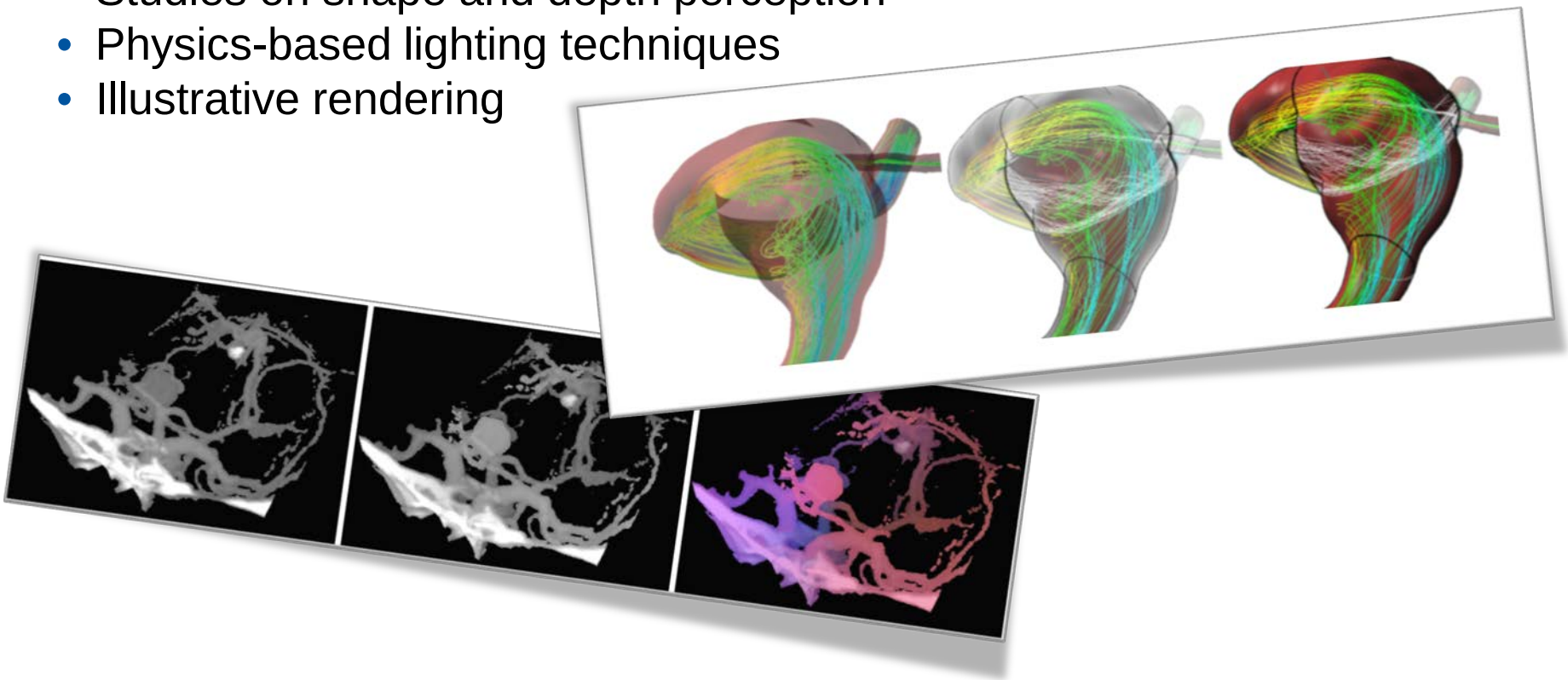
- **2017-04-24 10.15-11.45am** in the VR Lab at Kopernikussstr. 6
- Demo in aixCAVE and on other devices
- Register: http://doodle.com/poll/kgsaemwr7pa679b6
- optional



Seminar Topics

1. A Survey of Perceptually Motivated 3D Visualization of Medical Imaging Data

- Overview paper
- Studies on shape and depth perception
- Physics-based lighting techniques
- Illustrative rendering



Preim et al.: *A Survey of Perceptually Motivated 3D Visualization of Medical Imaging Data.* Computer Graphics Forum, Wiley, 35(3), pp 501-525, 2016.

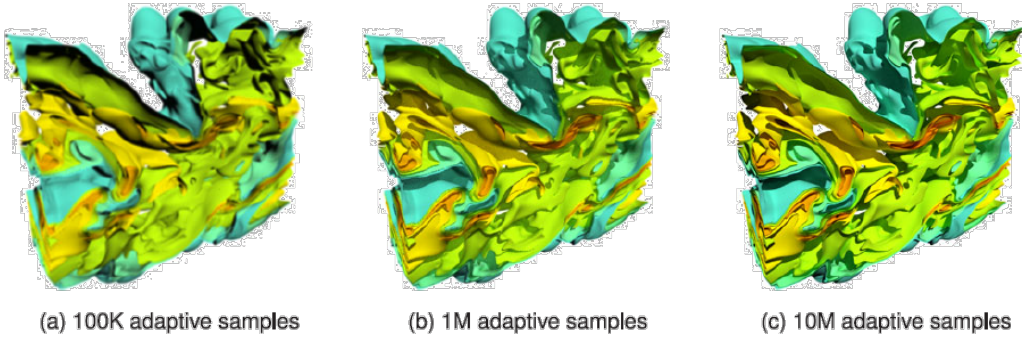
Advisor: Claudia Hänel

2. Frameless Volume Visualization

Kaloian Petkov and Arie E. Kaufman:

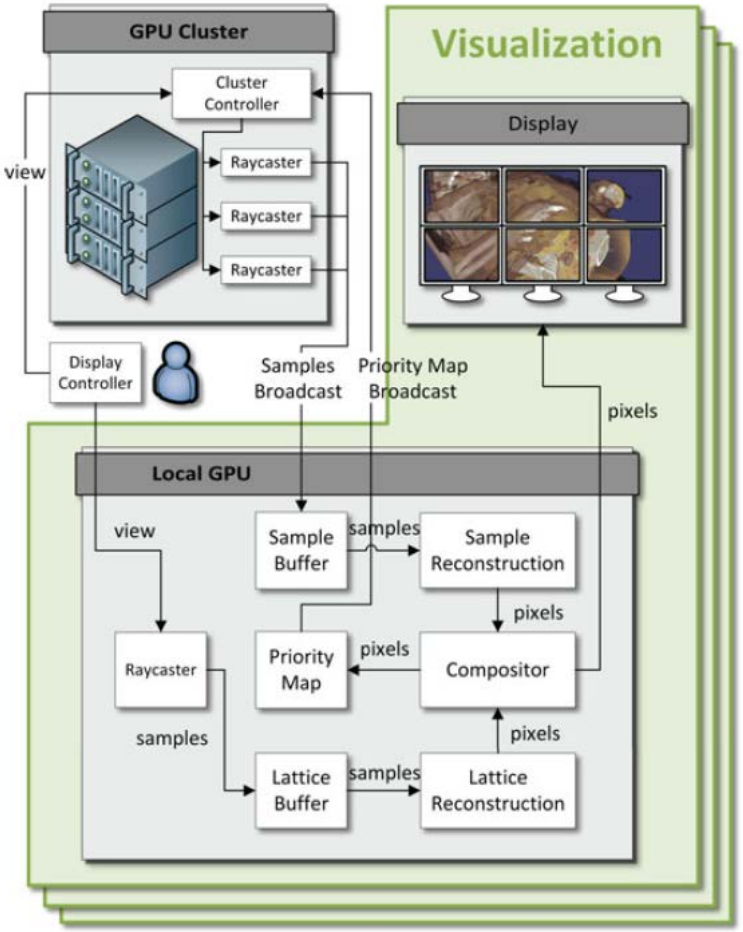
Frameless Volume Visualization

IEEE TVCG, February 2016



(a) 100K adaptive samples (b) 1M adaptive samples (c) 10M adaptive samples

(b) Visible Human



Advisor: Bernd Hentschel/
Claudia Hänel

3. Multi-Scale Navigation in Virtual Environments

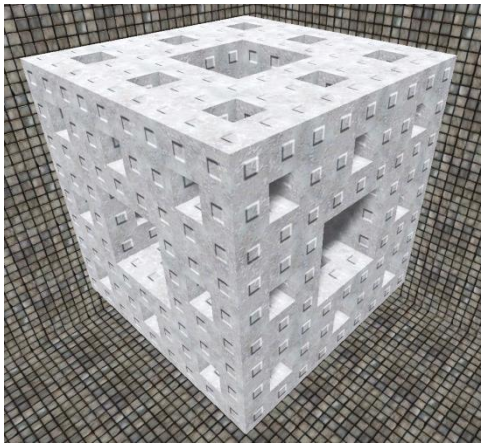
Argelaguet, F. & Morgant, M.:

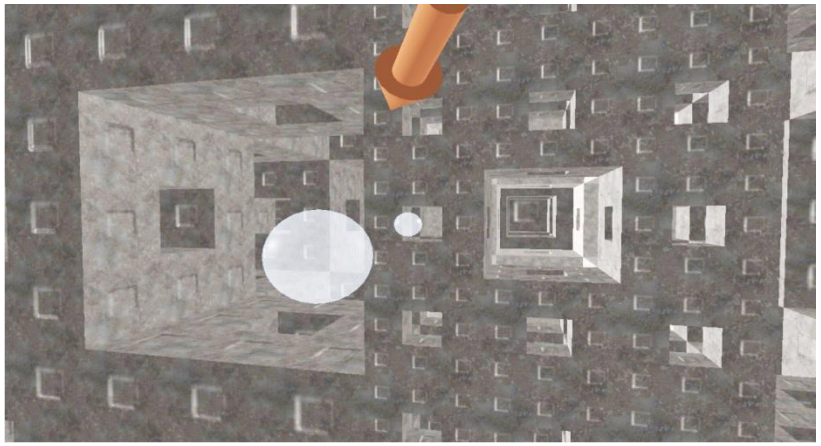
GiAnt: Stereoscopic-Compliant Multi-Scale Navigation in VEs

ACM VRST, November 2016

Navigation in multiple scales: need to adjust parameters!

Speed & stereoscopic parameters





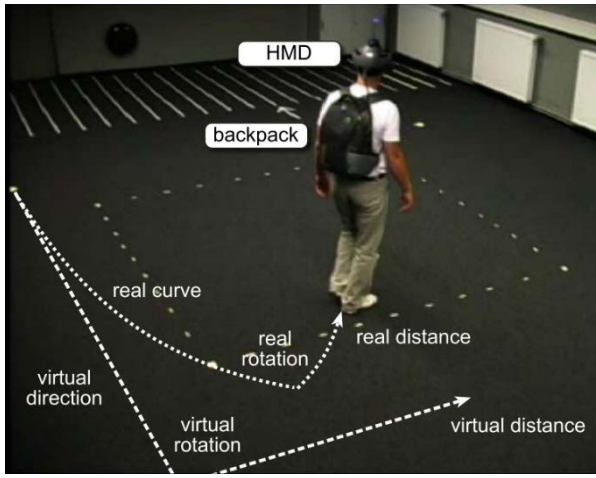
Advisor: Sebastian Freitag

4. Locomotion Prediction for Redirected Walking

Zank, M. & Kunz, A.:

Optimized Graph Extraction and Locomotion Prediction for Redirected Walking

IEEE 3DUI, March 2017

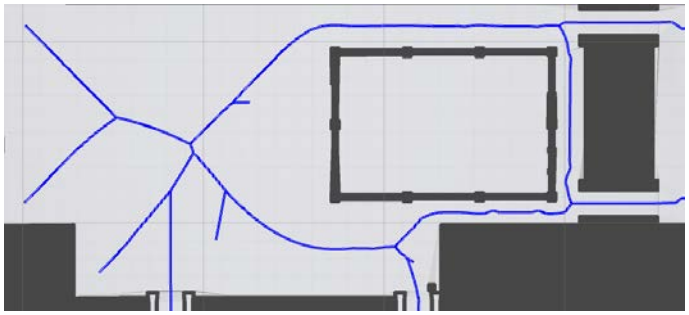


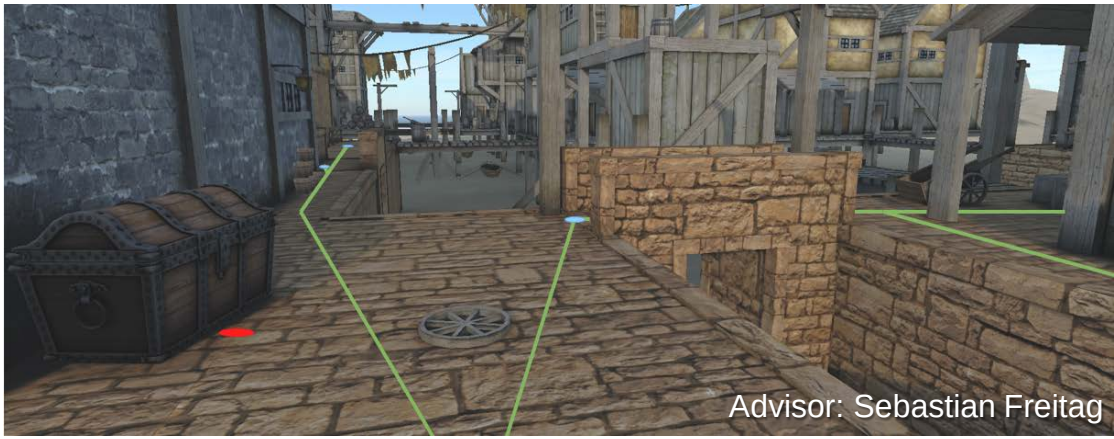
Redirected Walking: guide users away from walls

- Large areas necessary
- It's easier if we know where the user will go!

Predict Movement

- Eye tracking
- Structure of the environment!





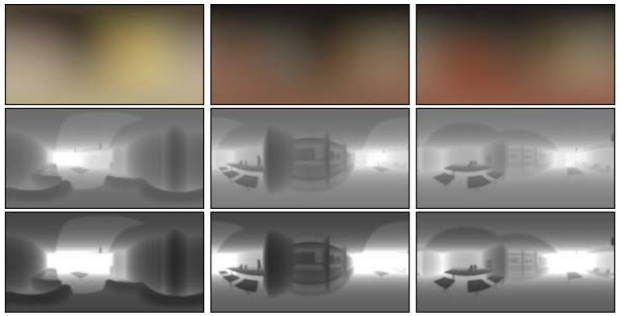
5. Real-Time Global Illumination using Precomputed Light Field Probes

- Morgan McGuire (NVIDIA), Michael Mara @ ACM SIGGRAPH i3D 2017.

- Introduces:
  - A data structure for storing radiance and geometric information of a scene.
  - A method to compute this structure from a scene definition.
  - A world-space ray tracing algorithm to create images using the structure.

- Further extended with prefiltered irradiance maps, which enables real-time.

- Comparative evaluation with similar global illumination approaches.



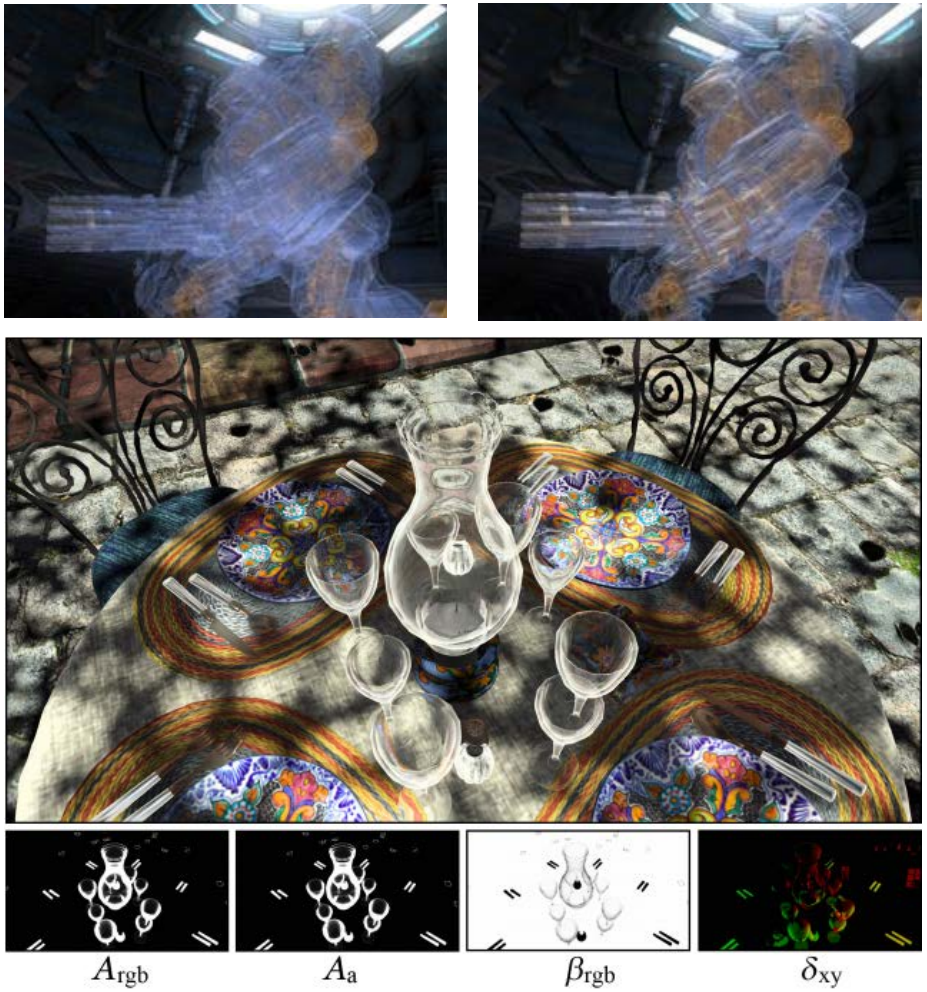
Advisor: Ali Can Demiralp

6. A Phenomenological Scattering Model for Order-Independent Transparency

- Morgan McGuire, Michael Mara, Derek Nowrouzezahrai, David Luebke @ ACM SIGGRAPH i3D 2016.

- Order-Independent Transparency:
  - Rendering transparency without requiring the rendered geometry to be in sorted order for alpha compositing.

- Introduces an algorithm which approximates several physical transparency phenomena in real-time:
  - Wavelength-varying (colored) transmission.
  - Translucent colored shadows.
  - Caustics.
  - Partial occlusion.
  - Diffusion
  - Refraction.



Advisor: Ali Can Demiralp

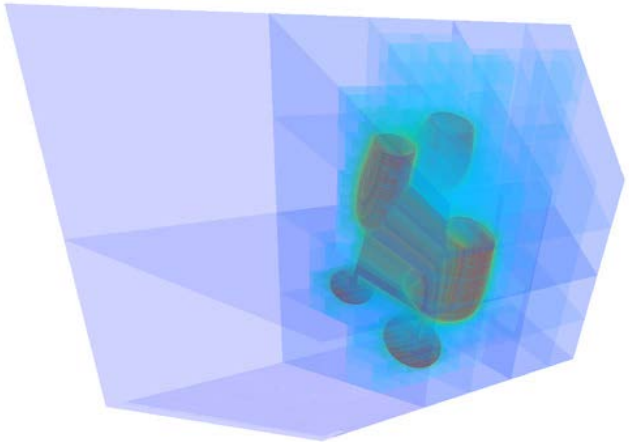
7. Lift-Off: Using Reference Imagery and Freehand Sketching to Create 3D Models in VR

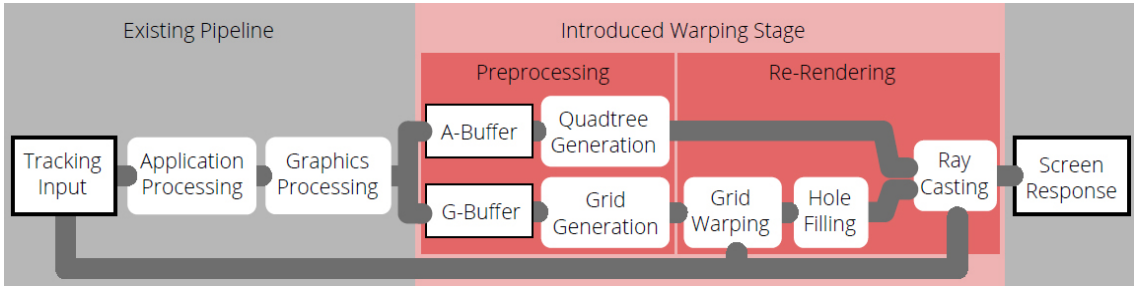
Jackson et al., IEEE Transactions on Visualization and Computer Graphics, 2016

- Create models from 2D sketches prepared offline
  - Extract 3D curves from input sketches placed in the IVE
  - Sweep surfaces along curves

Advisor: Sebastian Pick

8. Efficient Hybrid Image Warping for High Frame-Rate Stereoscopic Rendering





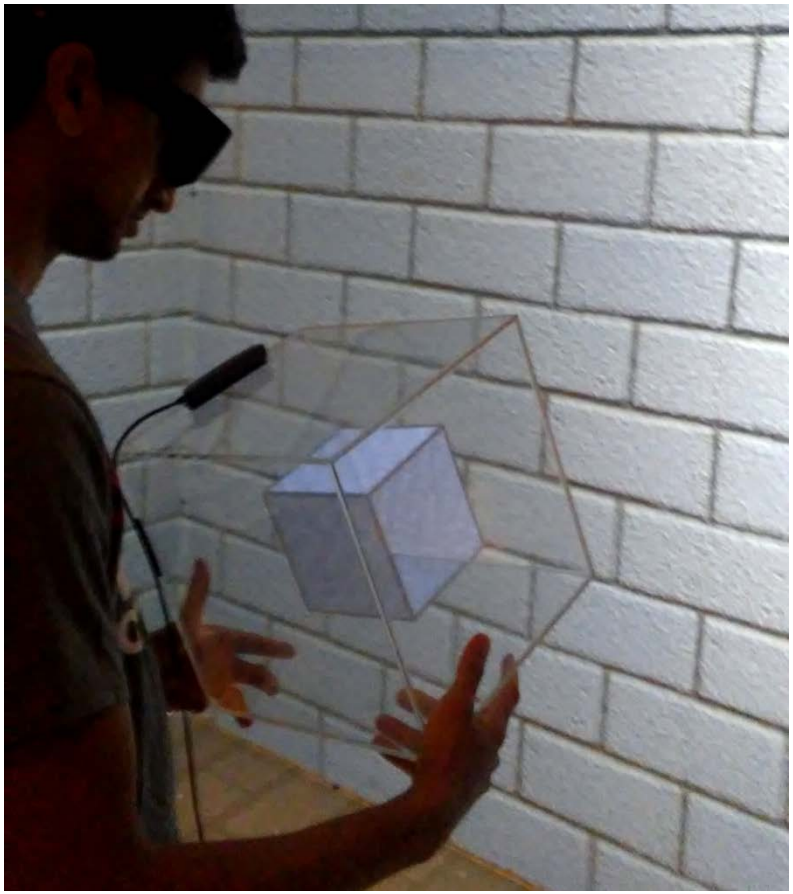
Schollmeyer et al., IEEE Transactions on Visualization and Computer Graphics, 2017

- Warp images to improve the creation of stereoscopic images
  - Re-warp images to fight dropped frames / latency
  - Create stereoscopic images from single monoscopic frames

Advisor: Sebastian Pick

9. Specimen Box: A Tangible Interaction Technique for World-Fixed Virtual Reality Displays (Zielinski et al., 2017)

- Acrylic box as tangible prop for projection-based VR environments
- Manipulation of box directly applied to contained virtual object
- User study comparing the approach to Grab-and-Twirl technique

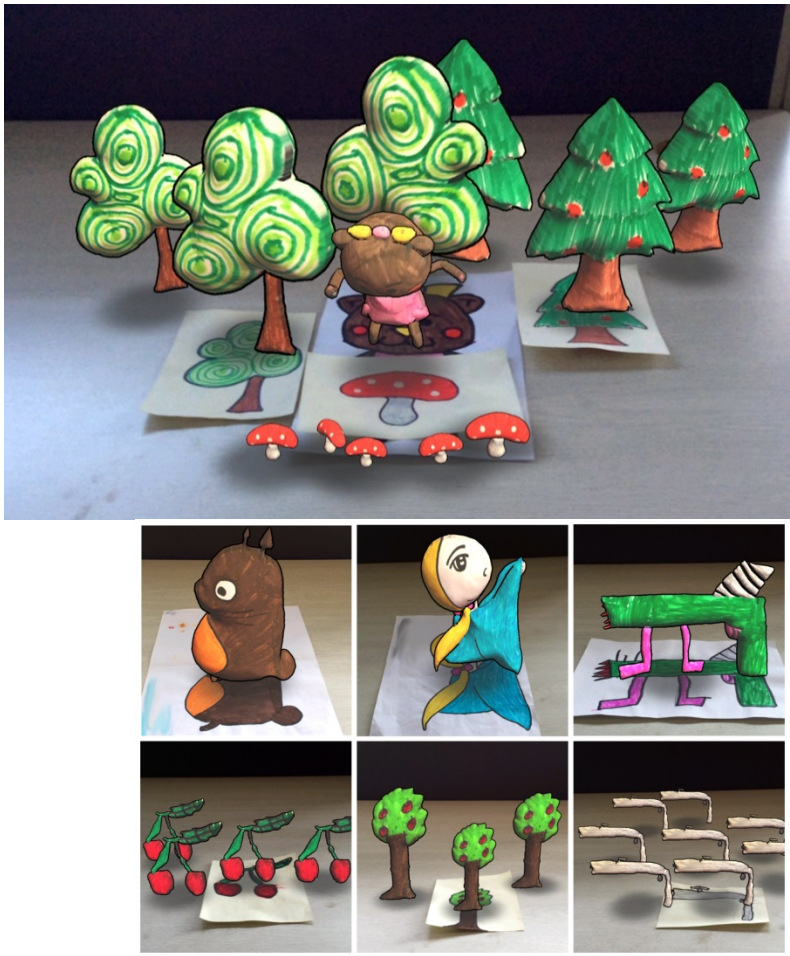


Zielinski et al.: Specimen Box: A Tangible Interaction Technique for World-Fixed Virtual Reality Displays. *IEEE 3DUI*. 2017

Advisor: Sascha Gebhardt

10. MagicToon: A 2D-to-3D Creative Cartoon Modeling System with Mobile AR (Feng et al., 2017)

- System to create 3D cartoon scenes from paper drawings
- Designed for children to be used on mobile devices
- Provides basic editing capabilities for scene creation, including transformation, replication, and character rigging for animation
- User study with 43 participants



Feng et al.: MagicToon: A 2D-to-3D Creative Cartoon Modeling System with Mobile AR. *IEEE VR*. 2017

Advisor: Sascha Gebhardt

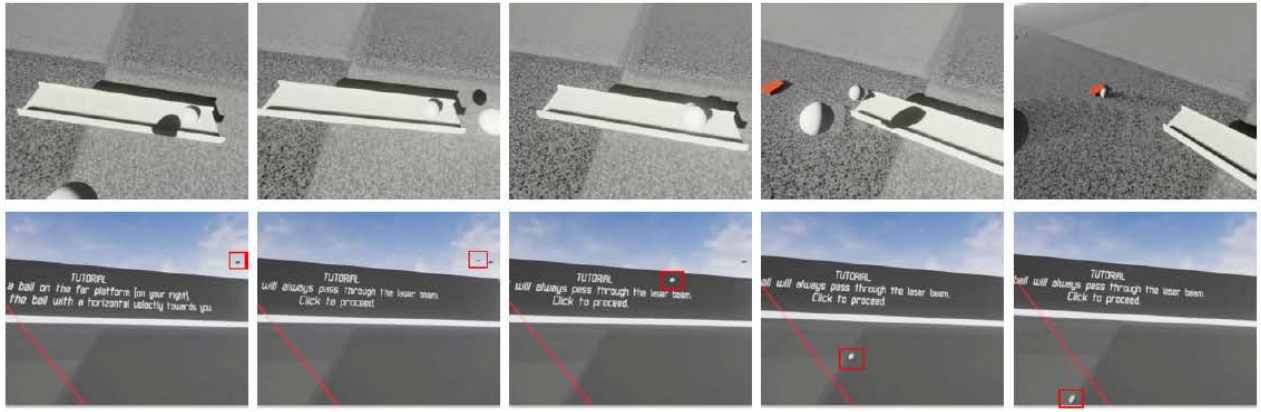
11. Semantic Entity-Component State Management Techniques to Enhance Software Quality for Multimodal VR-Systems

- Semantics based decoupling of subsystems based on an entity-component-system
- Provides a unified access scheme to application states
- Facilitates the integration of symbolic AI methods
- Improve maintainability of VR systems

Martin Fischbach et al.: IEEE TVCG Vol 23, No. 4, 2017

Advisor: Christian Nowke

12. The Martian: Examining Human Physical Judgements Across Virtual Gravity Fields



- Studies how humans adapt to novel physical situations with unknown gravitational accelerations
- Presents 4 experiments
- Compares 2 experiments to real-world performances
- 2 experiments measure human ability to adapt to new environments

Tian Ye et al.: IEEE TVCG, Vol. 23, No. 4, 2017

Advisor: Christian Nowke

Choose Your Topic

- Fill form
  - 3 prioritized choices
  - 1 no-go

- You‘ll get an e-mail with your topic and your advisor within the next couple of days
- Get back to your advisor ASAP!
- Talk to her about the topic, the focus of your work, and how to proceed…

Choose Your Topic (3 prioritized, 1 no-go)

1. A Survey of Perceptually Motivated 3D Visualization of Medical Imaging Data
2. Frameless Volume Visualization
3. Multi-Scale Navigation in Virtual Environments
4. Locomotion Prediction for Redirected Walking
5. Real-Time Global Illumination using Precomputed Light Field Probes
6. A Phenomenological Scattering Model for Order-Independent Transparency
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