Current Topics in the Field of Virtual Reality

Torsten W. Kuhlen, Jonathan Wendt

wendt@vr.rwth-aachen.de

Visual Computing Institute | Lehr- und Forschungsgebiet Virtuelle Realität und Immersive Visualisierung | RWTH AACHEN UNIVERSITY

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/16

- 3 weeks time to drop out without consequences (2017-11-06)
- 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, ..

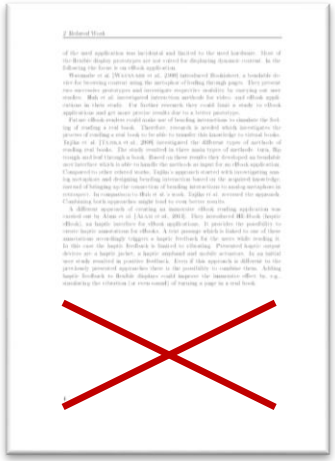
- **List of references & outline (deadline: 2017-11-06 8:00am)**
  - Key to getting your thesis set up
  - Fill the given template:
    - List all related papers that you deem relevant
    - Add a short explanation
    - Give an outline with short explanations

Writing the Seminar Paper

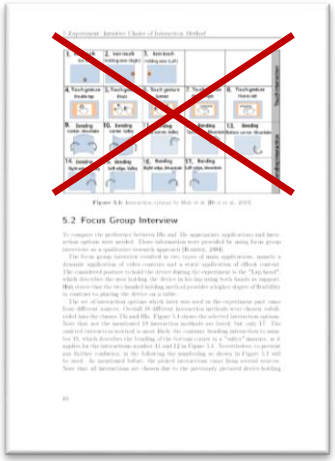
- Prepare a detailed discussion of your topic
  - Methods, techniques, and algorithms presented in the primary paper
  - Work closely with your advisor

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

- Deadlines:
  - **First version: 2017-12-18 8:00am**
  - **Final submission: 2018-01-22 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: 2018-01-29**
  - **Final presentation: 2018-01-31 12:30pm - 4:30pm**

Deadlines

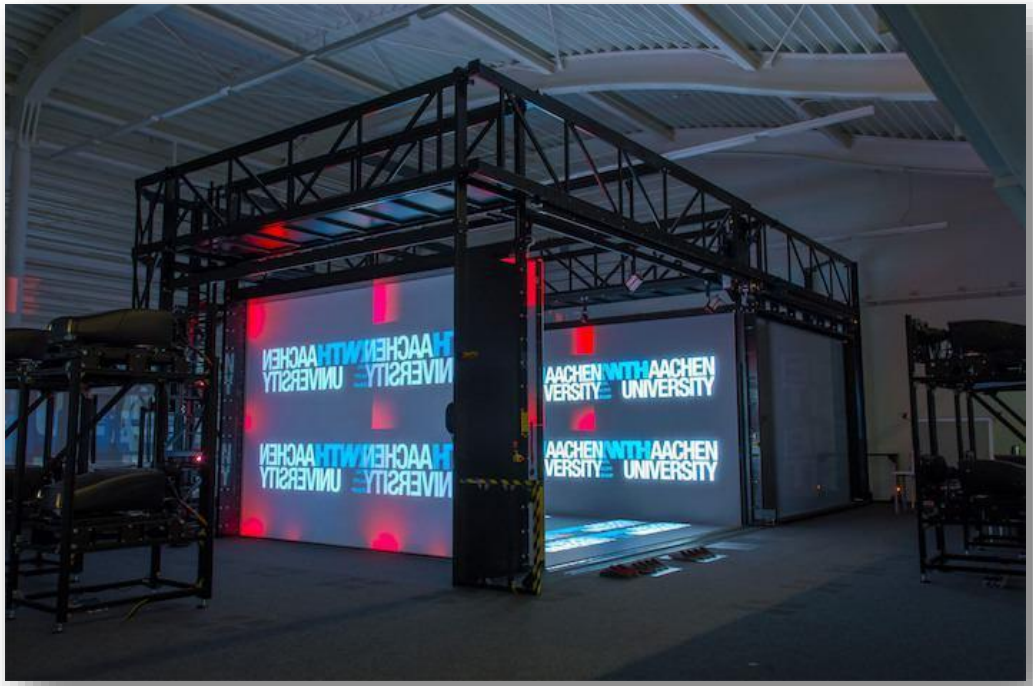
- Deadlines are hard
- Failing one deadline = failing the seminar

- Literature research/Outline: 2017-11-06 08:00am
- First submission: 2017-12-18 08:00am
- Final submission: 2018-01-22 08:00am
- Rehearsal talk till: 2018-01-29
- Final presentation: 2018-01-31 12:30pm - 4:30pm

Also on: https://www.vr.rwth-aachen.de/course/16/

VR Lab Demo

- **2017-10-24 9:30-11.30am** in the VR Lab at Kopernikussstr. 6
- Demo in aixCAVE and on other devices
- Register: https://doodle.com/poll/73kvasm4xr6g6tyy
- optional

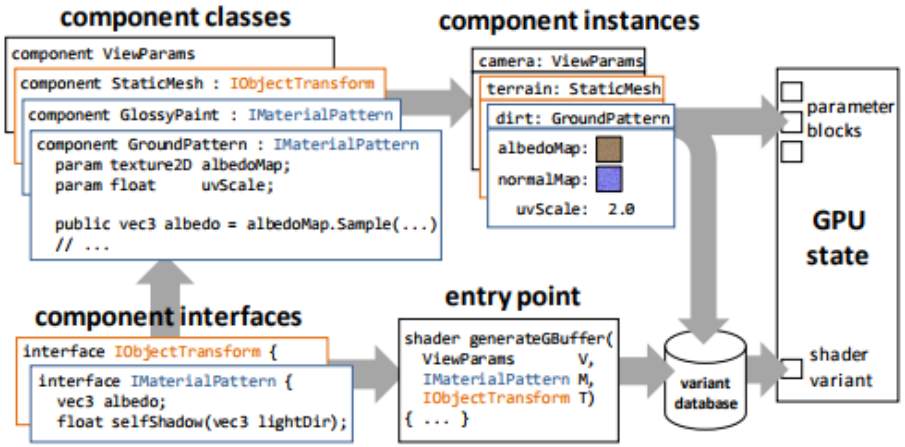


Seminar Topics

1. Shader Components: Modular and High Performance Shader Development

He et al. (NVIDIA)
SIGGRAPH 2017

- Present a shading language which compiles to both GLSL (OpenGL) and SPIR-V (Vulkan).
- Rendering features are isolated into small modules.
- Shaders are composed of these modules and their mappings.
- Open source:
  https://github.com/csyonghe/Spire

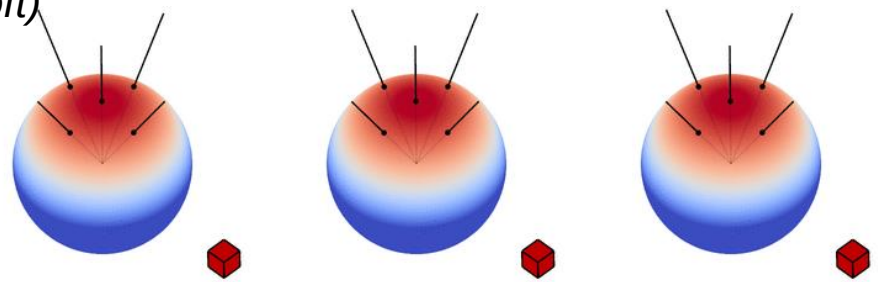


Advisor: Ali Can Demiralp

2. Real Time Polygonal-Light Shading with Linearly Transformed Cosines

Heitz, Dupuy, Hill, Neubelt (Unity3D,Ubisoft)
SIGGRAPH 2016

- Represent polygonal lights as spherical distributions.
- Estimate Physically Based BRDFs using linear transformations on the sphere.
- Code, detailed presentations and demos available:
  https://github.com/selfshadow/ltc_code
  http://blog.selfshadow.com/ltc/webgl/ltc_quad.html



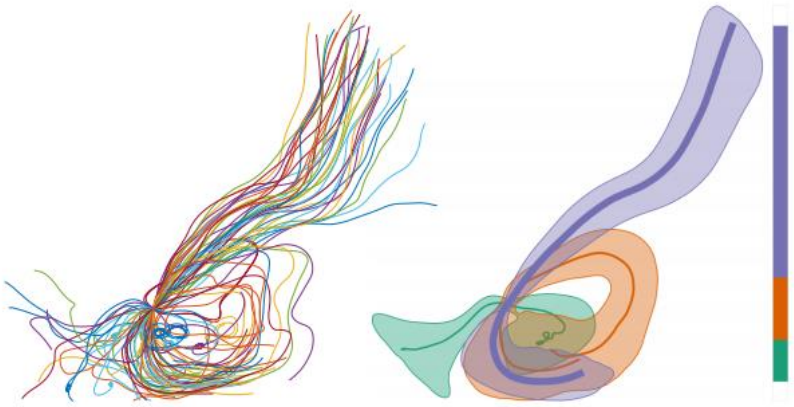
Roughness Anisotropy Skewness

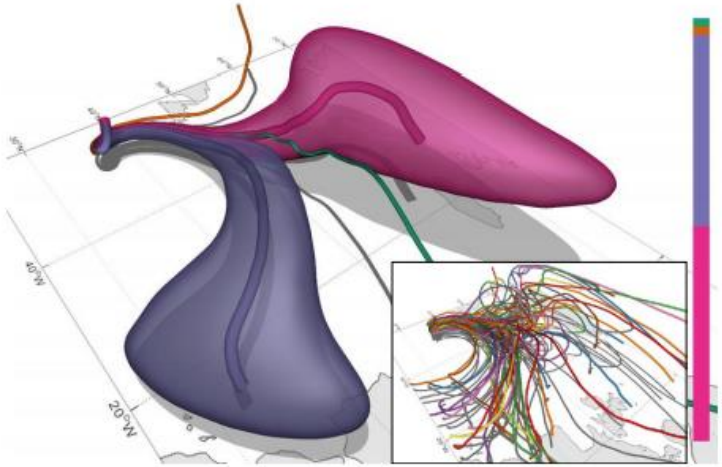
Advisor: Ali Can Demiralp

3. Streamline Variability Plots for Characterizing the Uncertainty in Vector Field Ensembles

Ferstl, Bürger, Westermann, TUM
IEEE VIS 2015

- Present a method to visualize the statistical properties of streamlines.
- Use Principle Component Analysis (PCA) to cluster streamlines into major trends.
- Estimate the streamline-median of each trend.
- The seminar content should particularly focus on steady flows.

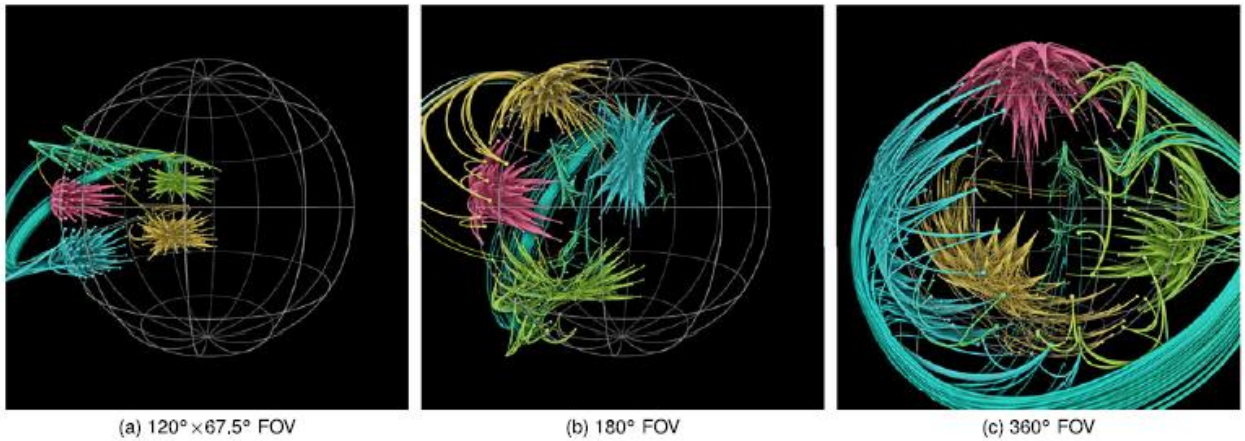


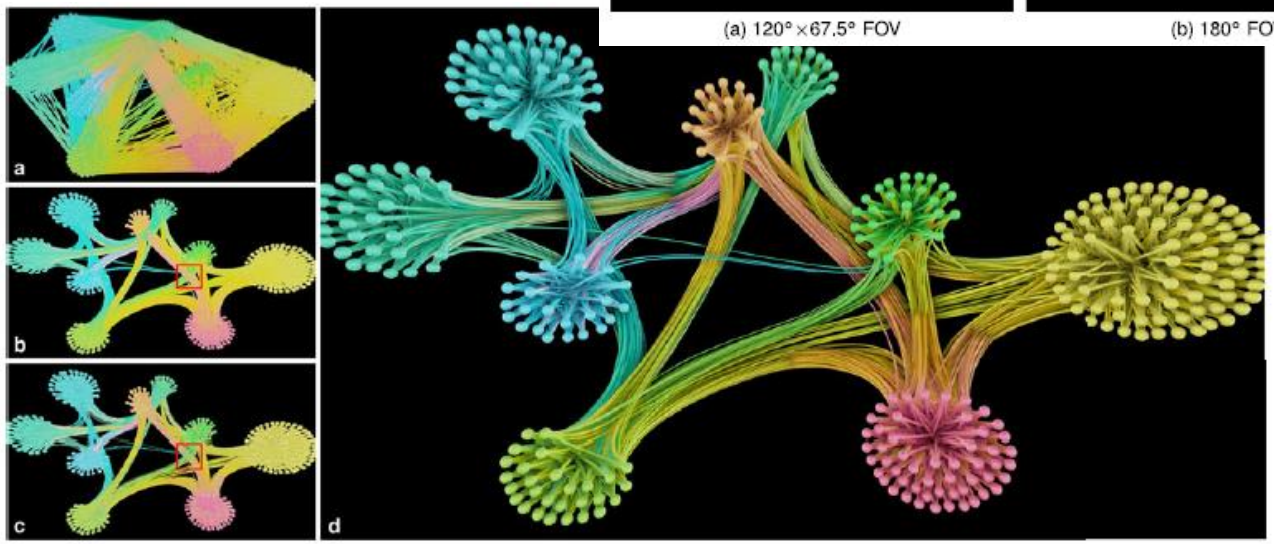


Advisor: Ali Can Demiralp

4. … Layout, Rendering, and Interaction Methods for Immersive Graph Visualization

Kwon et al.
TVCG ‘16



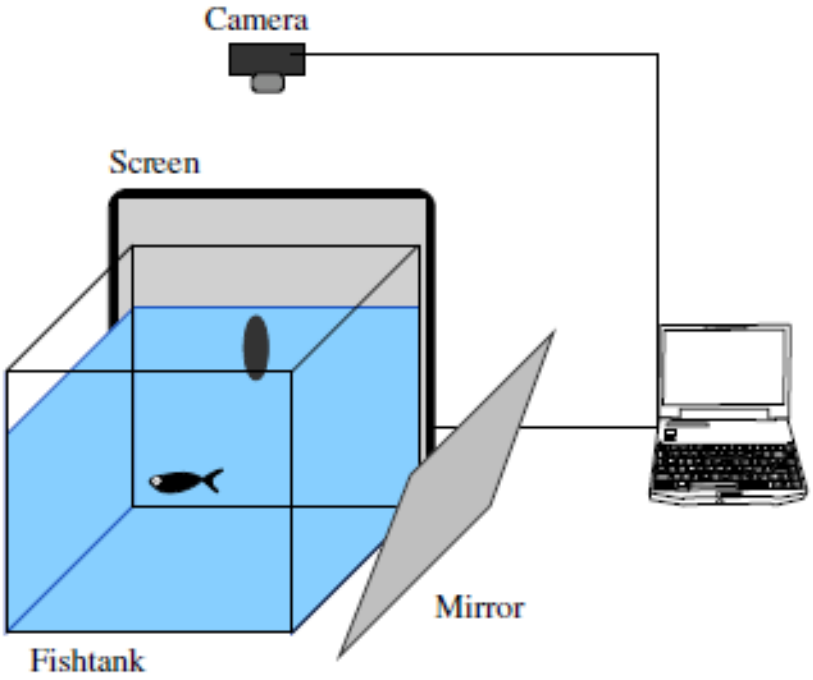


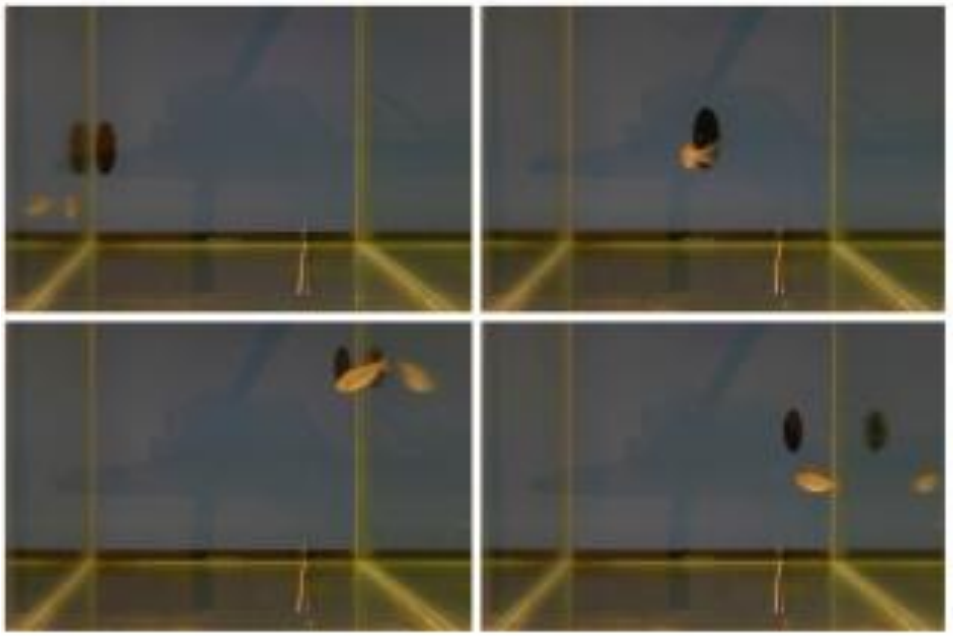
Advisor: Daniel Zielasko

5. Putting the fish in the fish tank: Immersive VR for animal behavior experiments

Sachit Butail, Amanda Chicoli and Derek A. Paley

Robotics and Automation ‘12





Advisor: Daniel Zielasko

6. Haptic Retargeting: *Dynamic Repurposing of Passive Haptics for Enhanced Virtual Reality Experiences*

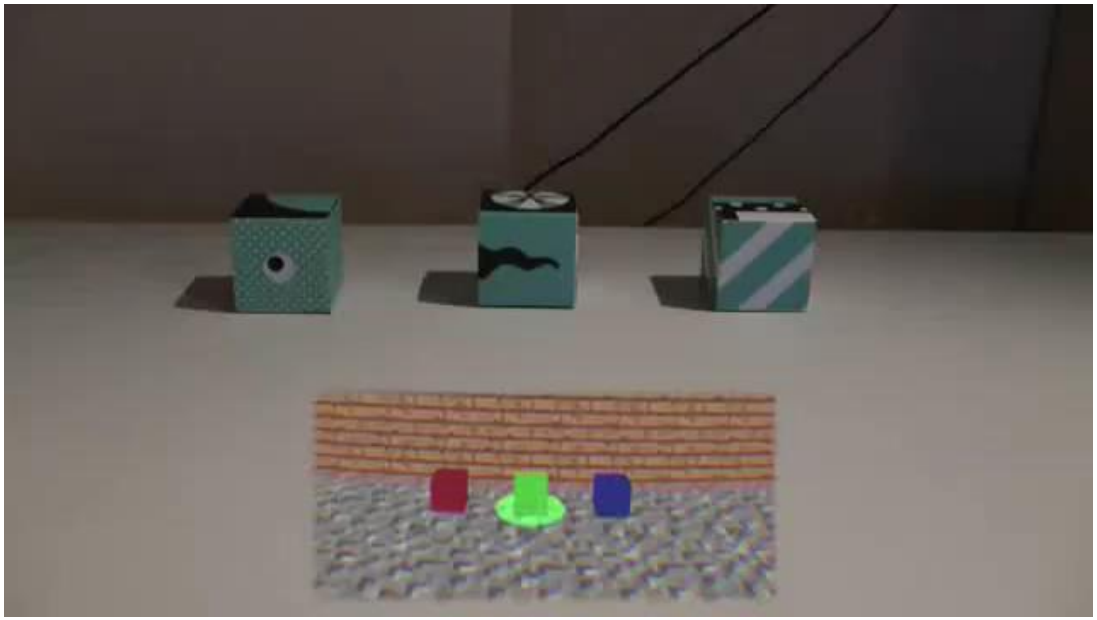
Azmandian, M., Hancock, M., Benko, H., Ofek, E., Wilson, Andrew D.
CHI Human Factors in Computing Systems, 2016

Passive haptics in VR

- Increases presence
- Hard to realize for changing environments

Retarget haptic feedback

- Use the same proxy for different virtual objects (or at different locations)
- (related to *Redirected Walking*)

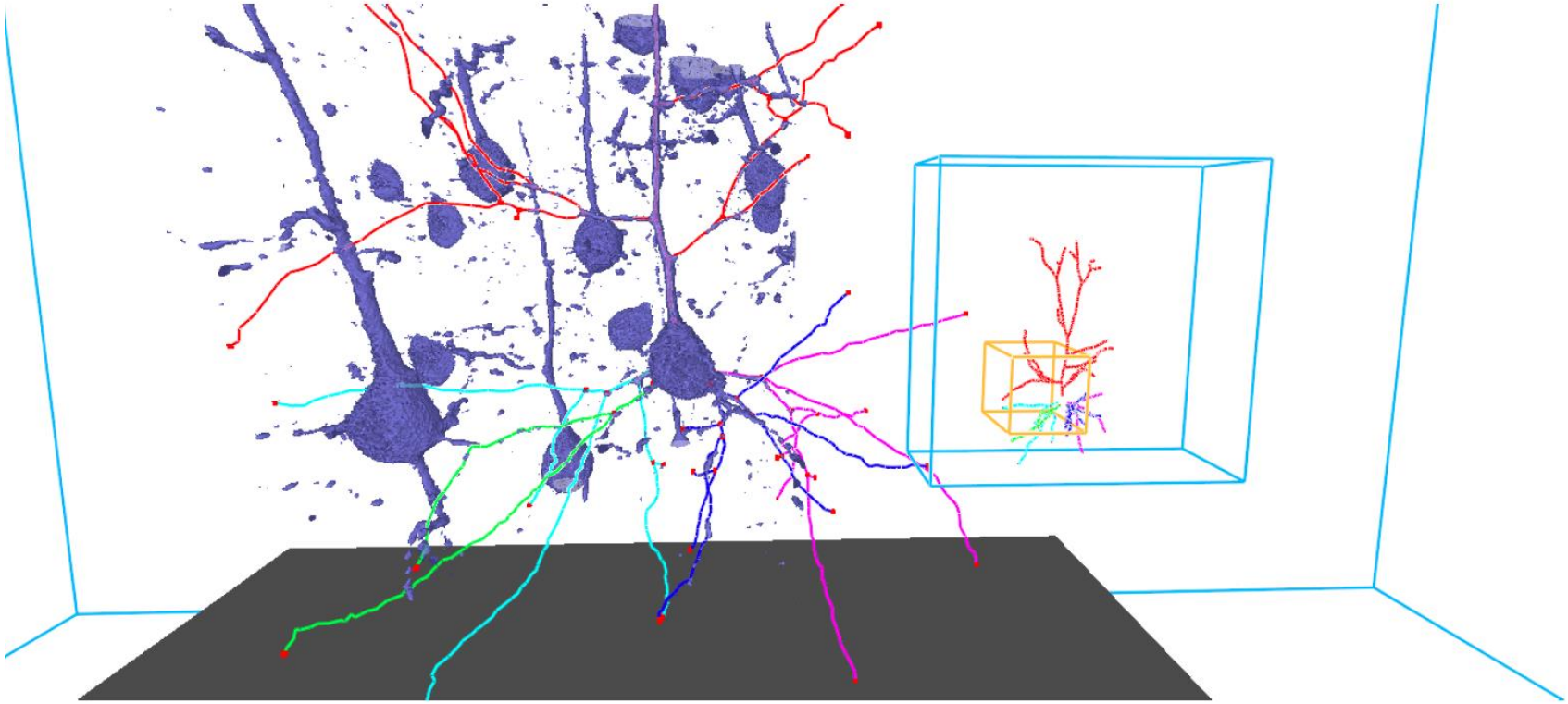


Advisor: Sebastian Freitag

7. A Virtual Reality Visualization Tool for Neuron Tracing

Will Usher, Pavol Klacansky, Frederick Federer, Peer-Timo Bremer, Aaron Knoll, Allessandra Angelucci, and Valerio Pascucci

IEEE VIS ‘17



Advisor: Bernd Hentschel

8. Synthesizing Obama: Learning Lip Sync from Audio

Supasorn Suwajanakorn, Steven M. Seitz, Ira Kemelmacher-Shlizerman

SIGGRAPH 2017

- Synthesize Speech-Video using Audio and a Target Video
- Use Neural Networks
- Blend Learned Mouth Movement into Video

Advisor: Jonathan Wendt

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. Shader Components: Modular and High Performance Shader Development
2. Real Time Polygonal-Light Shading with Linearly Transformed Cosines
3. Streamline Variability Plots for Characterizing the Uncertainty in Vector Field Ensembles
4. Layout, Rendering, and Interaction Methods for Immersive Graph Visualization
5. Putting the fish in the fish tank: Immersive VR for animal behavior experiments
6. Haptic Retargeting*:* Dynamic Repurposing of Passive Haptics for Enhanced Virtual Reality Experiences
7. A Virtual Reality Visualization Tool for Neuron Tracing
8. Synthesizing Obama: Learning Lip Sync from Audio