
Computer Graphics

- Introduction -

Philipp Slusallek

Overview

- **Today**
 - Administrative stuff
 - History of Computer Graphics (CG)
- **Next lecture**
 - Overview of Ray Tracing

General Information

- **Core Lecture (Stammvorlesung)**
 - Applied Computer Science (Praktische Informatik)
 - Lectures in English
- **Time and Location (in presence or hybrid)**
 - Mon 10-12h c.t.
 - Thu 8:30h-10h s.t.
- **ECTS:**
 - 9 credit points
- **Web-Page**
 - <http://graphics.cg.uni-saarland.de/courses/>
 - Schedule, slides as PDF, etc.
 - Literature, assignments, other information
- **Sign up for the course on our Web page now**
 - [Do not forget to sign-out in time before the exams, if you need to]

People

- **Lecturers**

- Philipp Slusallek, slusallek@cg.uni-saarland.de

- **Assistants**

- Alexander Rath, rath@cg.uni-saarland.de
- Stefan Lemme, lemme@cg.uni-saarland.de

- **Tutors (see web page for contact details)**

- Niklas Mennig
- Adarsh Djeacoumar
- Kevin Raj
- Amin Parchami

Exercise Groups

- **Will be announced through Teams**

Weekly Assignments

- **Weekly assignment sheets**
 - Theoretical & programming assignments
 - You will incrementally build your own ray tracing system
 - This will be the basis for the → **Rendering Competition**
- **Grading**
 - Results of the exercises will contribute to the final grade
 - Bonus points (towards the exam) are possible
- **Handing in assignments**
 - Theoretical: At beginning of lecture
 - Code: See exercise sheet (usually by email to tutor)
- **Exercise meetings**
 - Discuss lectures and any issues you might have with TAs
- **Groups of max. 2 students allowed**
 - Each one must be able to present and explain his/her results!
 - Please state who did what!!!

Grading

- **Weekly Assignments**
 - Counts 30% towards final grade (with +20% bonus points)
- **Rendering Competition (exam prereq.)**
 - Counts 10% towards final grade
 - Grading: Artistic quality (jury)
 - Groups of max. 2 students (but higher requirements then)
- **Exams**
 - Mid-term (exam prereq.), counts 20% towards final grade
 - Final exam counts 40% towards final grade
 - Minimum: 50% to pass (in each of the above)
- **Cheating**
 - 0% of assignment grade on first attempt
 - Possibility to fail the entire course if repeated
- **Chance for Repeated Exam**
 - Oral exam (if possible) at the end of the semester break

Rendering Competition

- **Task**

- Create a realistic image of a virtual environment
- Incorporate additional technical features into your ray tracer
- Bonus points count towards exam
- Creative design of a realistic and/or aesthetic 3D scene
- Modeling and shading

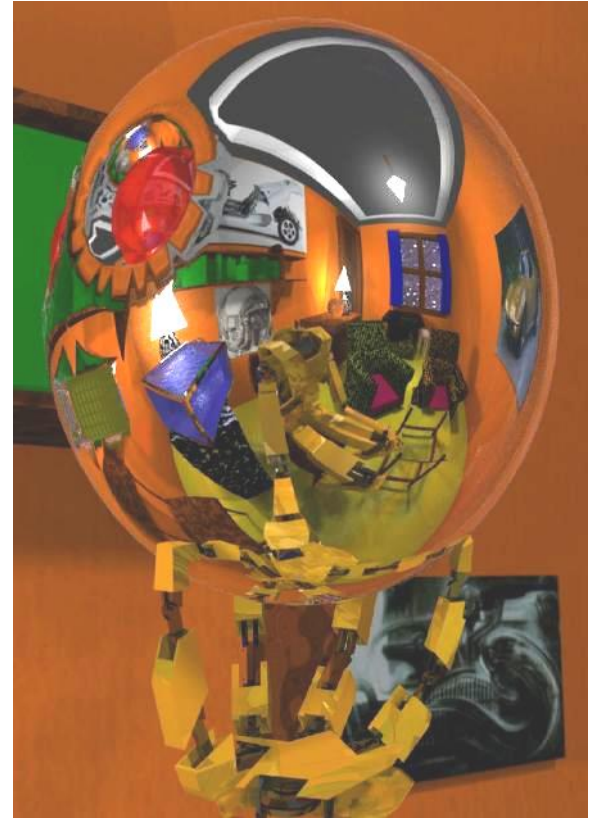
- **Hand-out in course**

- You can work on it parallel to the course
- Deadline will be announced (see Web page)

- **Results:**

- One rendered image
- Web page with technical detail info

Rendering Competition



Rendering Competition



Text Books

- **Suggested Readings:**

- Peter Shirley: **Fundamentals in CG**, 4. Ed, AK Peters, 2016
NEW: 5th edition came out recently
- John Hughes, et al.: **Computer Graphics – Principles and Practice**, Addison-Wesley, 3. Ed, 2013
- Matt Pharr, Wenzel Jakob, Greg Humphreys: **Physically Based Rendering : From Theory to Implementation**, Morgan Kaufmann Series, **3. Ed., 2016, now freely available:** <http://www.pbr-book.org/>
- Eric Haines and Tomas Akenine-Möller: **Ray-Tracing Gems**, <http://www.realtimerendering.com/raytracinggems>
- Thomas Akenine-Möller, Eric Haines, et al., **Real-Time Rendering**, AK Peters, 4th Ed., 2018

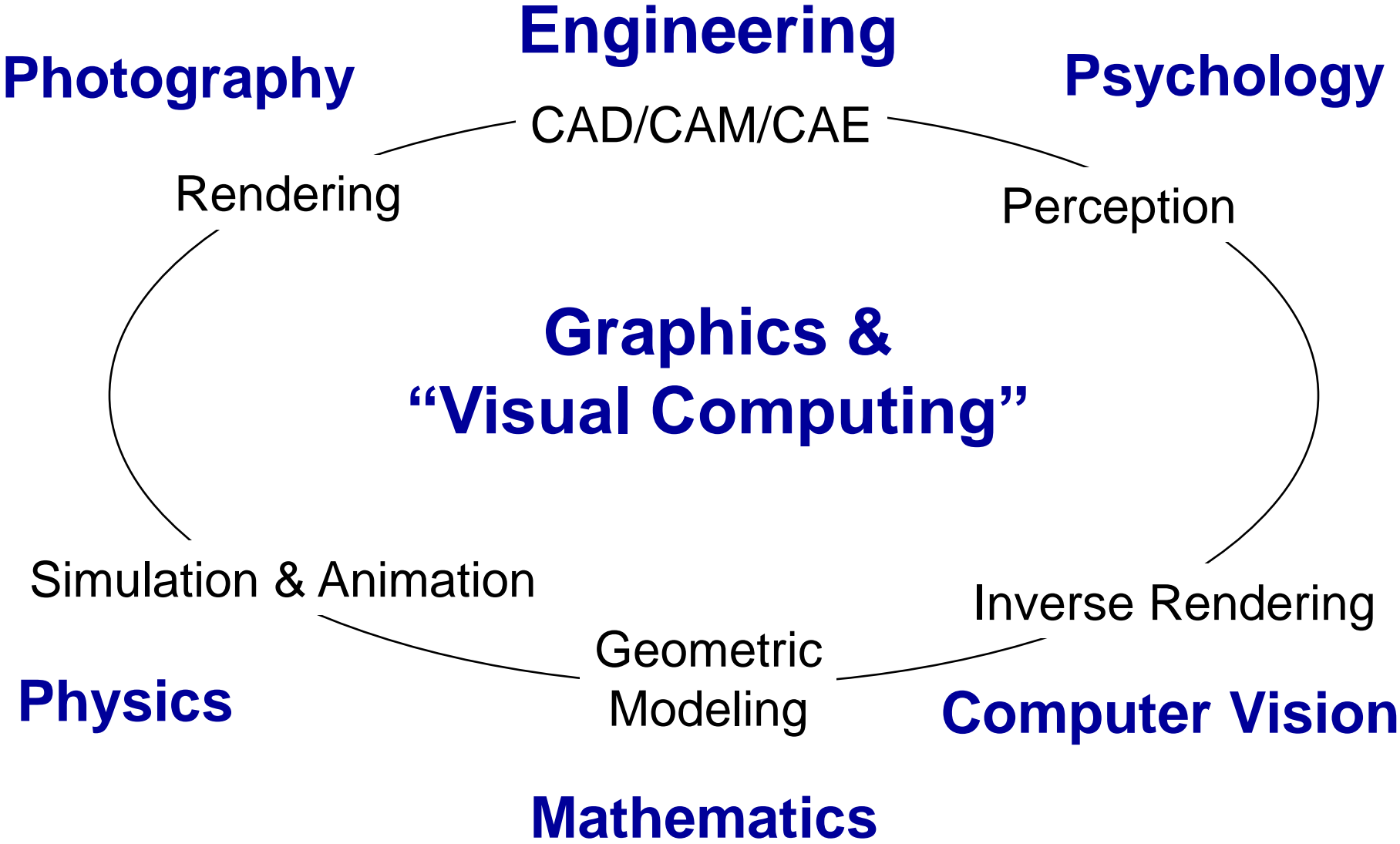
- **Older**

- A. Glassner: **An Introduction to Ray-Tracing**, Academic Press, '89
- D. Ebert: **Texturing & Modeling – A procedural approach**, MK, '03

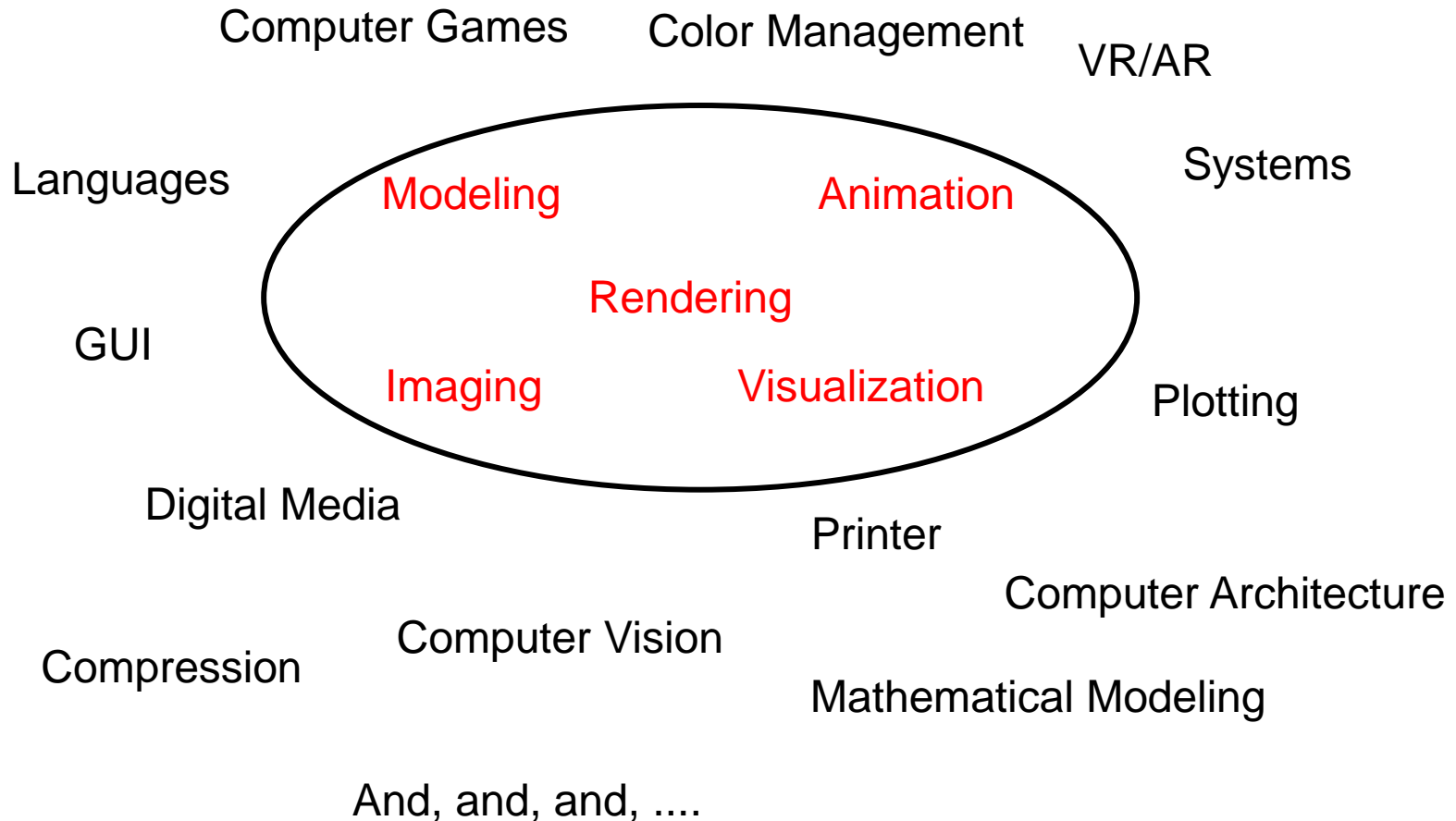
Course Syllabus (Tentative)

- **Overview of Ray Tracing**
- **Geometry Intersections**
- **Spatial Index / Acceleration Structures**
- **Vector Algebra Review**
- **Geometric Transformations**
- **Light Transport / Rendering Equation**
- **Material Models**
- **Shading**
- **Texturing**
- **Spectral Analysis / Sampling Theory**
- **Anti-Aliasing**
- **Distribution Ray Tracing**
- **Human Vision**
- **Color**
- **Splines**
- **Clipping**
- **Rasterization**
- **OpenGL & Shading Language**
- **Volumes**

What is Computer Graphics ?



What is Computer Graphics?



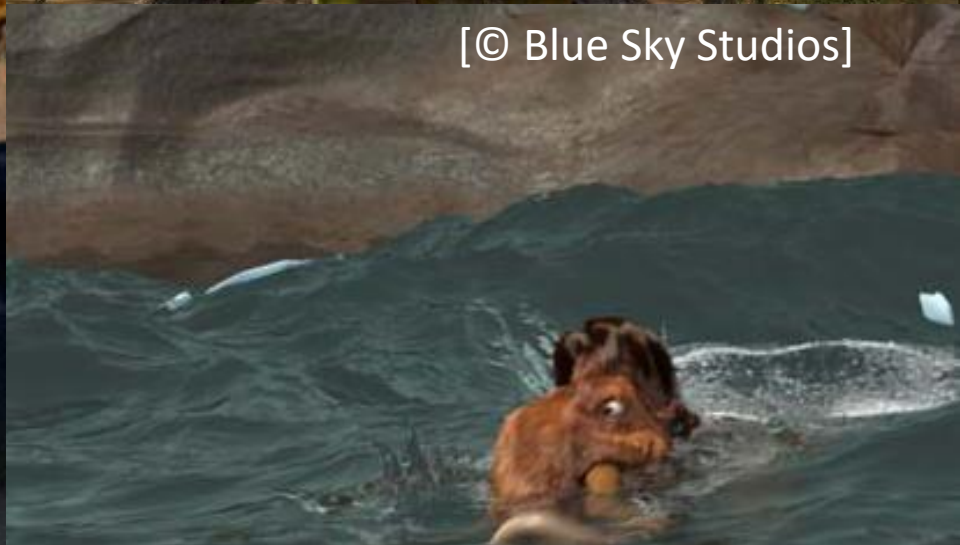
Applications

- Entertainment Industry: Special effects for motion pictures



Applications

- Entertainment Industry: Animated films



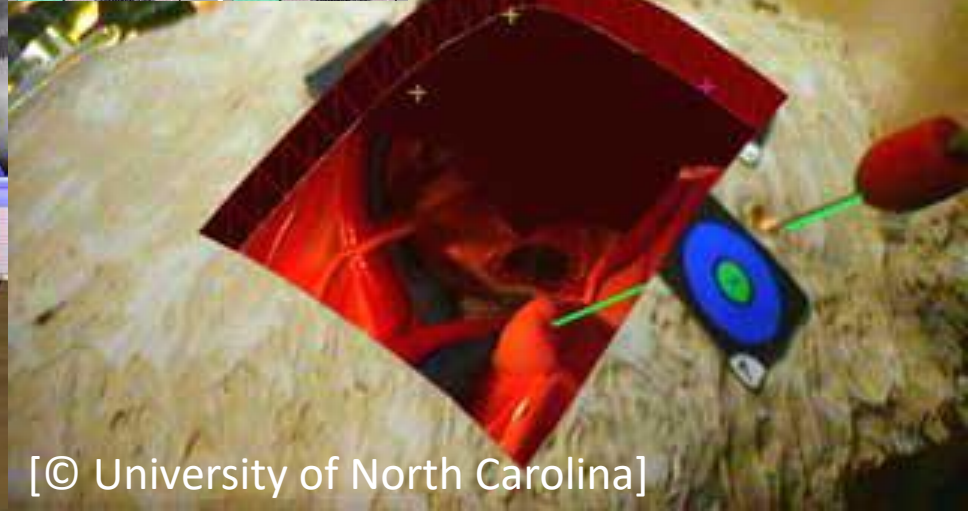
Applications

- Entertainment Industry: Video games



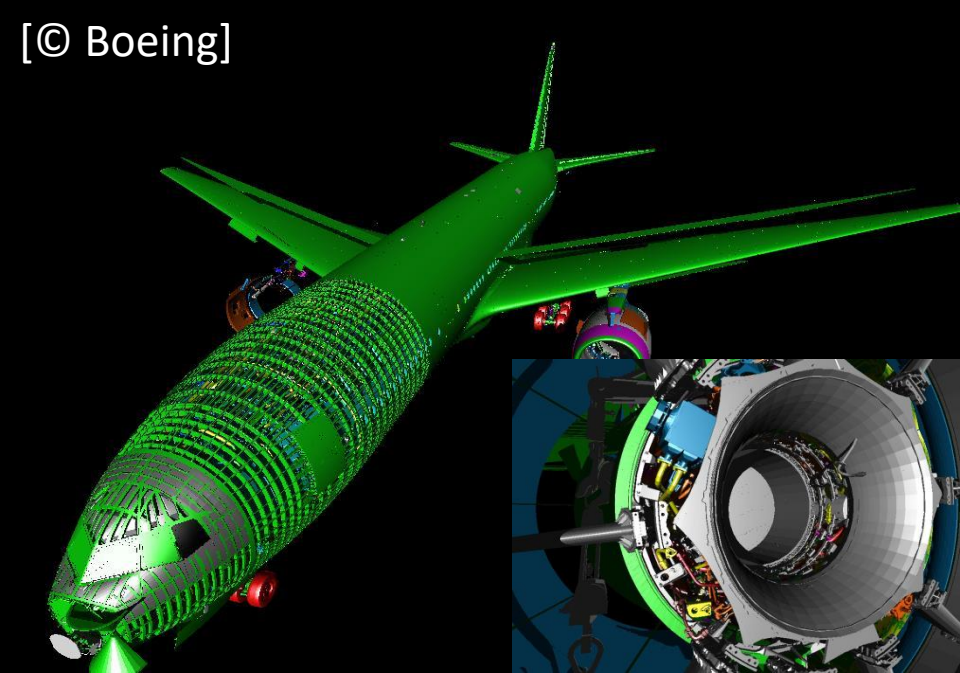
Applications

- Simulation & Augmented Reality



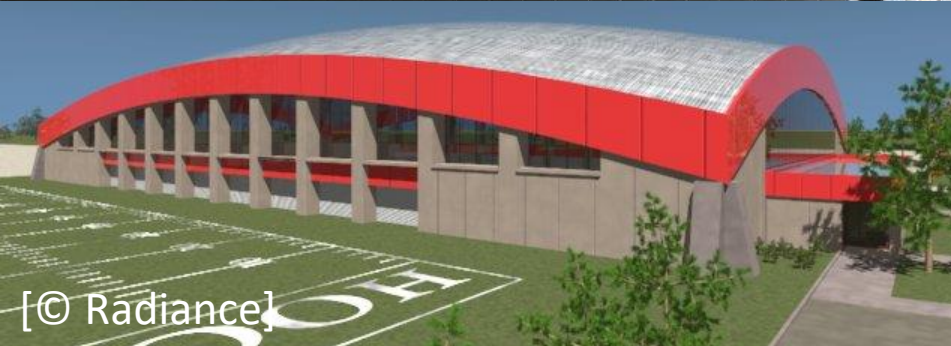
Applications

- Industrial Design & Engineering: Automotive / Aerospace



Applications

- Architectural / Interior Design
- Landscape / Urban Planning
- Archeological Reconstruction



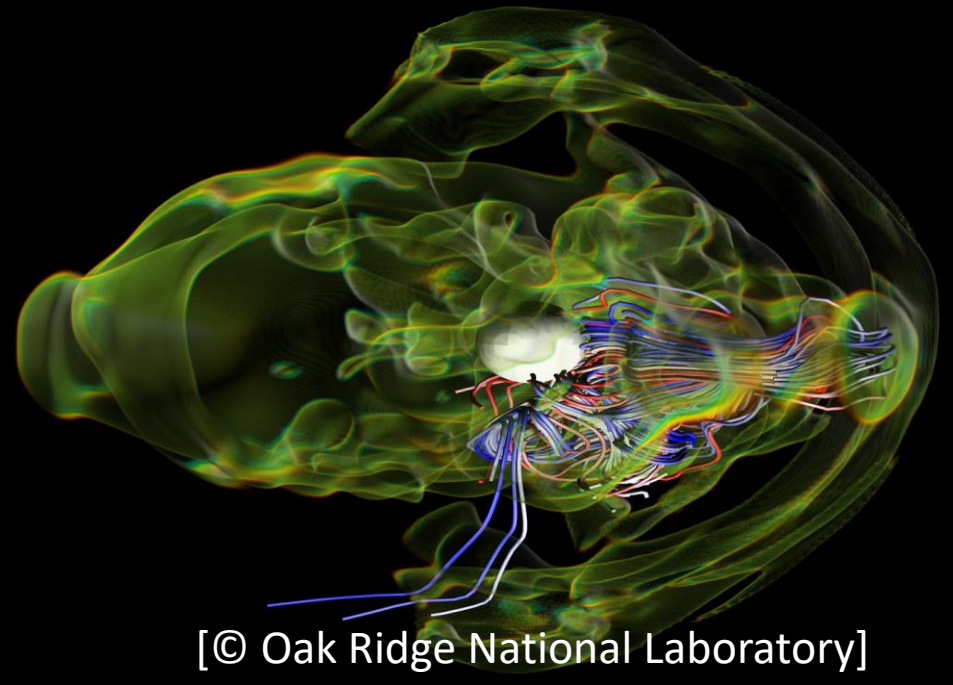
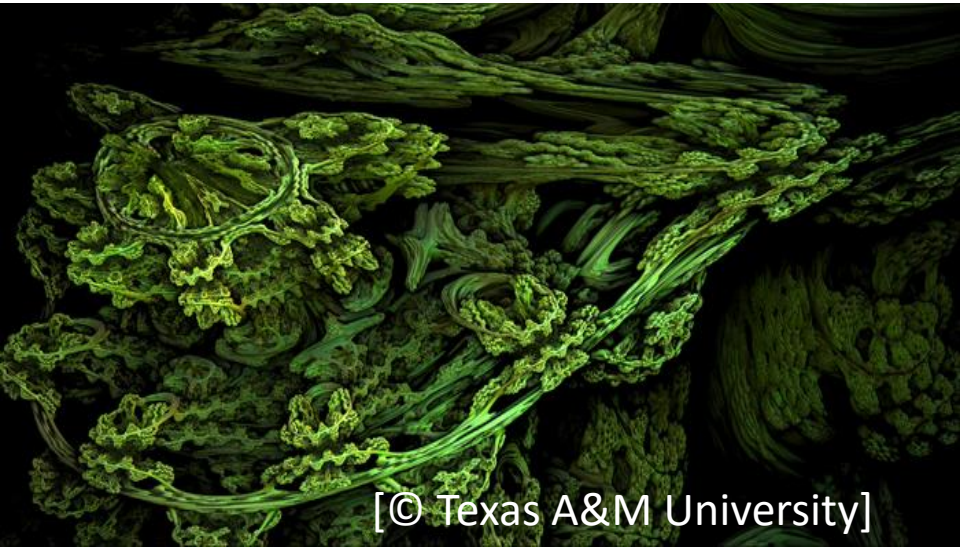
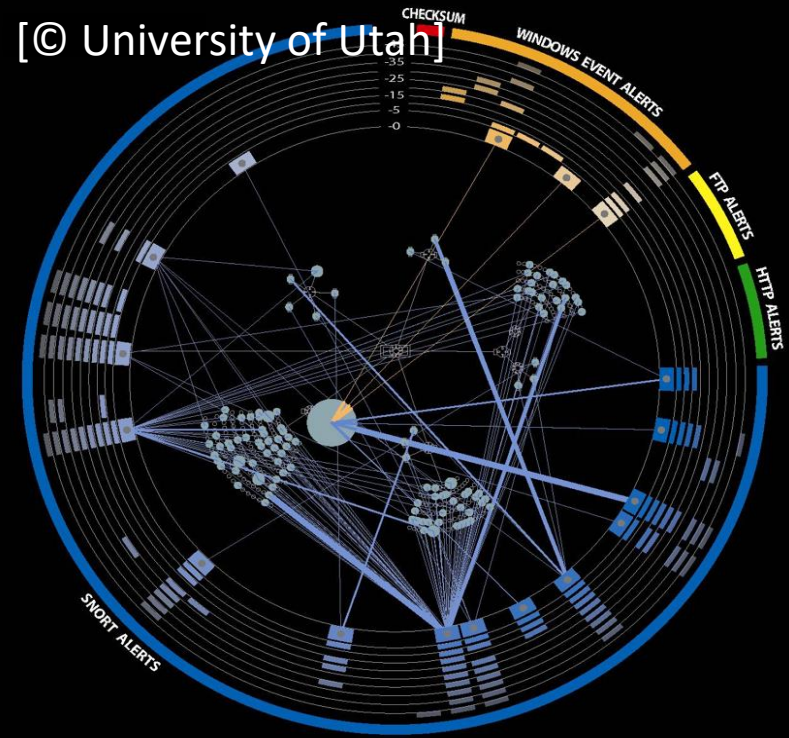
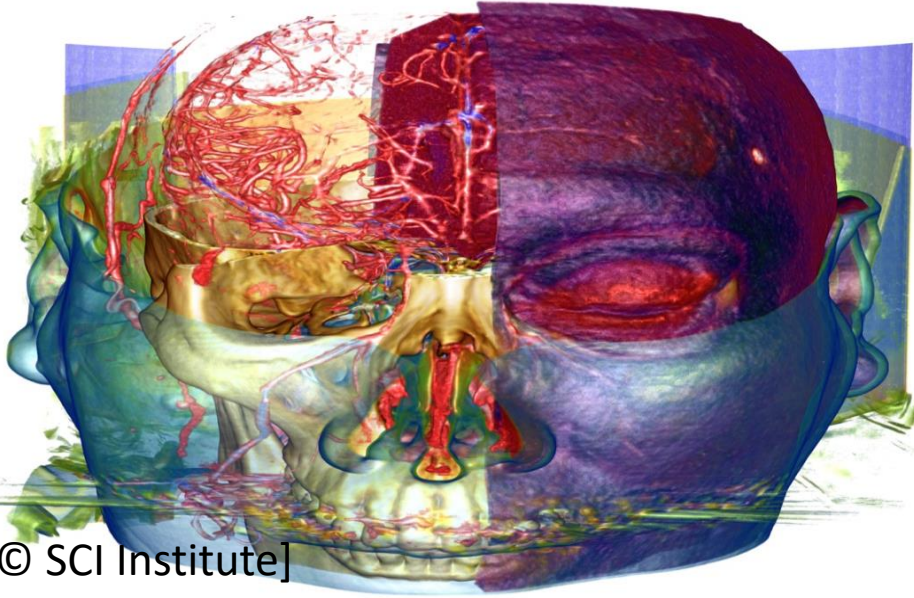
[© PBRT]

[© Radiance]

[© University of Bristol]

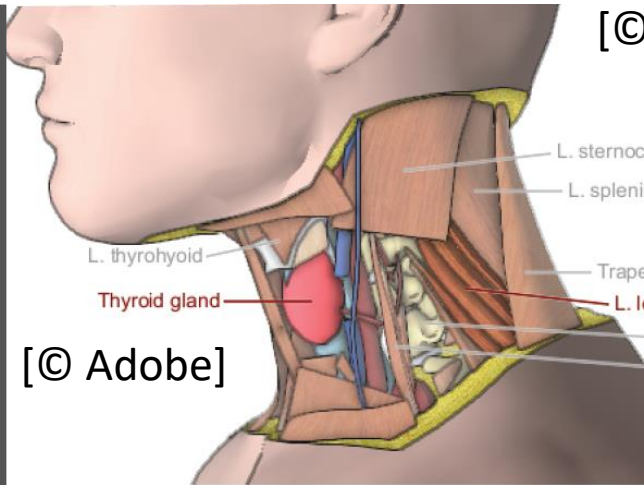
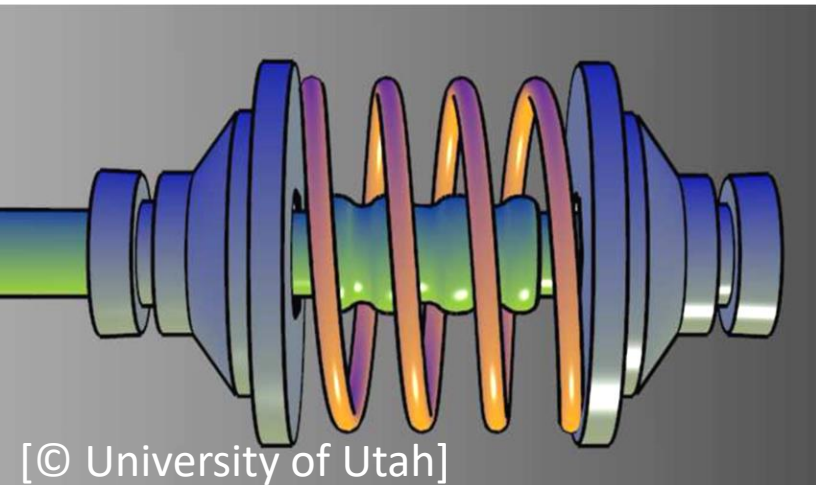
Applications

- Scientific/Information Visualization

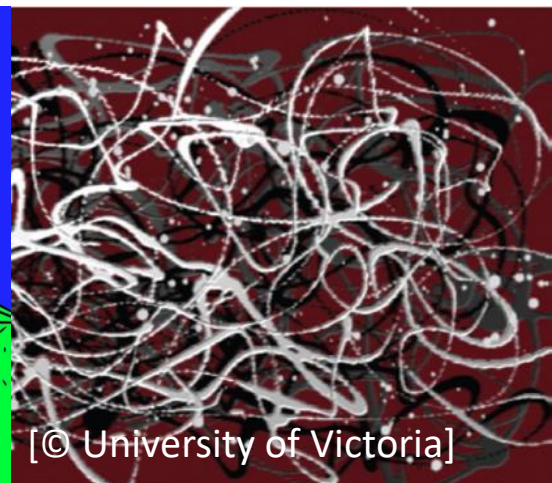
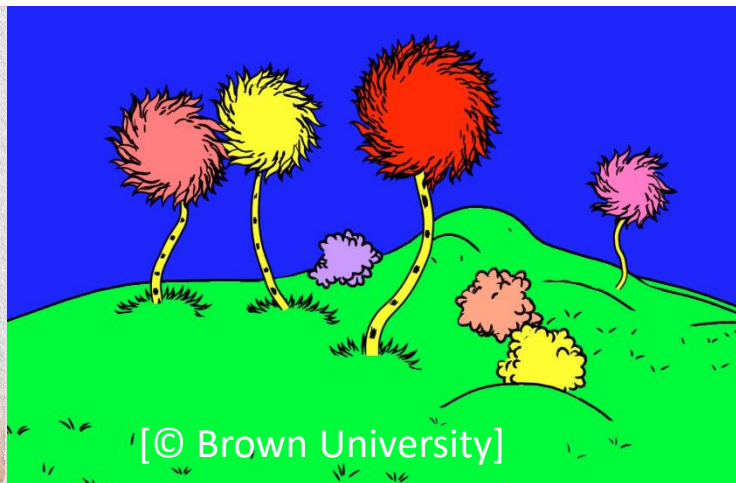
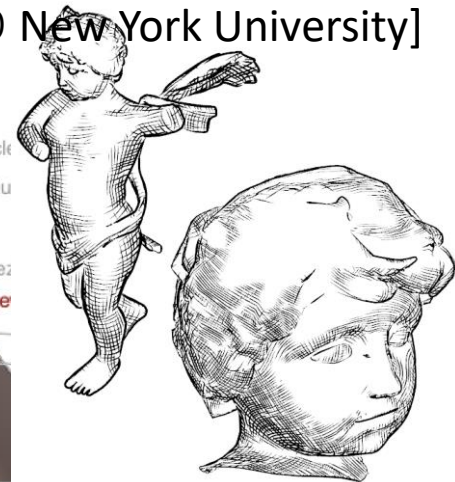


Applications

- Non-photorealistic rendering: art/stylized/pen&ink illustration
- Painterly/Toon Shading, Computational Aesthetics



[© New York University]



Wrap-Up

- **Computer Graphics**
 - Rendering, Modeling, Visualization, Animation, Imaging, ...
- **Young, dynamic area**
 - “Everything is possible” mentality
 - Progress driven by research & technology
 - Flexible transfer between research and industry
- **Big industry !**
 - Intel, Nvidia, AMD, Imagination, ARM, ...
 - Automotive, aerospace, engineering, ...
 - Entertainment: games, film, TV, animations, ...
- **Innovation areas**
 - Digital Reality, Visualization, Industrie-4.0, Big Data, Smart Cities, ...
- **Interdisciplinary field**
 - Relations to mathematics, physics, engineering, psychology, art, entertainment, ...